FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

Fighter Philosophy

SINCE we published our article on "Fighter Philosophy" in last week's issue it has become permissible to refer in some little detail to the armament of the Mark II Hurricane.

It is interesting to compare the ideals formulated by Mr. Lawrence Bell, whose firm has been responsible for the Airacobra, and those represented by the Hurricane Mark II. To get the greatest possible fire power into the air was the aim of the Americans, and to that end the Bell concern designed a machine with tricycle undercarriage and shaft transmission from an engine placed behind the pilot. That made possible the placing of a cannon in the nose and two machine guns in the wings.

Alternative armament of the Hurricane Mark II is 12 machine guns or four 20 mm. cannon. In spite of Mr. Bell's amusing reference to bringing down a multi-engined bomber by firing rice at it, the intensity of fire from 12 0.303 machine guns is devastating, and the same may, of course, be said of the four-cannon version, with its long range and great penetration, not to mention the greater explosive charge which is contained in four 20 mm. shells. The central cannon in the Airacobra is of 37 mm., but one imagines that the destructive power of the four smaller cannon is considerably greater than that of the one larger gun.

Both the new Hurricane versions have been in action, and it has been reported that recently they sank two German *flak* ships and four minesweepers off the Belgian coast, so there is not much doubt about their effectiveness.

That the Hawker concern has been able to incorporate such terrific fire power in a type of fighter which is virtually six years old is little short of amazing. It is true, of course, that the Merlin engine fitted is of greater power, so that a better performance is attained compared with the Mark I, but in all its structural essentials the Hurricane Mark II is unchanged. It shows what can be done with a quite orthodox aeroplane of good basic design, even when of general-purpose type.

Equally successful, in a different category, has proved the twin-engined Beaufighter, the four cannon and six machine guns of which have been found to give such tremendous intensity of fire that targets disintegrate. Both the Hurricane II and the Beaufighter have given proof of the correctness of Mr. Bell's contention, a contention, by the way, which originated in this country and resulted in our heavy armament of aircraft, that the aim should be to get the most powerful concentration of fire into the air.

M. Maisky's Estimate

THE Russian Ambassador to Britain presumably gets good information, and when he told the American Chamber of Commerce in London that the Germans had lost three million men in casualties of all sorts, that about one-third of their Army was now *hors de combat*, and that their losses in aircraft amounted to some 8,500 machines—all in thirteen weeks of fighting on the Eastern front—he must have had sound chapter and verse for his statements.

German factories may be able to replace 8,500 aircraft in not too lengthy a period, despite the attentions of the R.A.F. Bomber Command (for German aircraft factories are widespread and the country is extensive), but it will not be such a simple matter to replace the air

crews. The R.A.F. Training Command knows well the time which it takes to train each member of an air crew, even by the intensive methods used in time of war. The Germans may cut the time still shorter, but if they do their men will be less competent, and that will tend to give our own men an advantage even greater than that which they already possess over the enemy. Moreover, even though the lost German aircraft may be replaced, losses on such a scale as M. Maisky stated must have upset the German programme to no small extent.

We must be thankful to our Allies for the losses which they have inflicted on the common enemy, but we must not delude ourselves into thinking that the Germans will not be able to make some heavy raids on this country during the coming winter. They will probably not be able to keep them up, night after night, on the scale of last autumn, and if their crews are less experienced our defences should be able to bring down more of them.

The moral is that we are not only bound to spare machines and men to help the Russians, but that we can afford to do so with less risk to ourselves.

New Ideas from Canada

COL. GEORGE DREW, an ex-officer of artillery and leader of the Canadian Opposition, gave a most inspiring broadcast last Friday evening. He made it plain that the ideas which he expressed were only his personal views, but they showed an originality of thought which was most refreshing, and, incidentally, he completely concurred with certain opinions which *Flight* has consistently held and expressed.

In particular, Col. Drew warned his listeners that it was futile to expect to defeat Germany by strategic bombing and blockade. We make no claim to be an authority on naval questions, but it must be obvious to everybody that the naval blockade cannot have the same effect on the enemy in this war, when he is in possession of most of the Continent of Europe, and when France and the French Navy are no longer helping us, as it did in the war of 1914-18. That is not to say that the blockade is not useful and must not be maintained, for it certainly has a hampering effect. The same is true of strategic bombing. It is useful, it does harm to the enemy, and it must be continued. Our protest has been, and is, against prophecies and assurances that that sort of bombing by itself will win the war. Col. Drew called that idea "a dangerous fallacy."

Col. Drew reminded his hearers that to produce the same result in Germany as the enemy could produce here, our bomber force must be very much larger than theirs, as our bombers must fly a great deal farther and cover a target area about twelve times as big.

Yet Col. Drew did not in any way depreciate the usefulness of air action when employed to the best advantage. He urged that, while our Army could not be so large as that of the Germans, it ought to develop harder hitting power, and it must have the full support of an Air Component—evidently a large one. Col. Drew laid great stress on combined training of the ground troops and the aircraft over a sufficiently long period, and certainly over an extensive training ground. Salisbury Plain, he asserted, is much too small for the purpose, and he advocated training the combined force in Canada.

It is for others to consider the feasibility of this scheme, but its originality and broad conception make a strong appeal. This advocacy of a large Air Component training for a considerable time over huge tracts of country with a powerful ground force tallies to a striking degree with the opinions of General Sir Iven Mackay, on which we recently commented. Thus we see similar ideas springing up independently from the two extremes of the Empire, Canada and Australia. It is to be hoped that at the Centre, Whitehall, these ideas will receive the fullest consideration.

SEINE ASSAULT. Bombs bursting on the power station, a chemical factory, sidings and among shipping at Grand Queville, near Rouen, during a recent daylight raid by Blenheims of Bomber Command.

END OF A STUKA. A.A. guns brought down this Ju 87 during a raid on Tobruk—another German "Success!"

War in the Air

The Wing in Russia : Rescues in the Channel : Harrying Libyan Ports

THE first report from the R.A.F. Wing in Russia is encouraging. In its earliest engagement with the enemy one of the squadrons shot down three Me 109s for the loss of one of our own machines, and later the same squadron got four more German fighters without loss to itself. This report indicates that the squadron concerned is a fighter squadron, and, as the Germans are now well aware of the fact, there can be no harm in mentioning it for the benefit of British readers. It has also been announced that the Wing Commander's name is H. N. G. Ransbottom-Isherwood, A.F.C., a New Zealander. The men in the Wing come from Great Britain (which perhaps is meant to include Northern Ireland), Canada, Australia, and New Zealand. The squadrons have also been escorting Russian bombers.

At the moment of writing the general fighting in Russia is confused, and the rival communiqués are not very enlightening. The Germans report air raids on Leningrad and Moscow, and also claim that their bombers and dive-bombers have scored hits on Russian battleships and a destroyer in the bay of Kronstadt. The Crimea is also said to have been raided by the *Luftwaffe*. Kharkov, which is threatened by the German advance in the Ukraine, contains five aircraft factories and possesses several aerodromes.

Hitler has been bringing pressure to bear on Bulgaria to join him in the war against Russia, and stories have been put about that Russian parachute troops landed on Bulgarian territory. This allegation may be only an excuse by the Germans or by the war party in Bulgaria. The Turkish population has been expelled from Yambol, or Jamboli, which is described as a great centre of air activity. It was from this base that the Zeppelin L59 started on her remarkable flight down as far as Khartum and back in November, 1917, carrying medical supplies which were intended for the forces of Gen. von Lettow-Vorbeck in Tanganyika; so the air history of the place is impressive.

Daring Beauforts

THE northern front, that is to say, the British Isles and the land and water adjacent to them, is for the moment of minor interest, though at any moment things may flare up again in that region. The Coastal Command Beauforts have been very busy interfering with German sea traffic along the coasts of the Continent. The pilots rival in daring their comrades of the Bomber and Fighter Commands. Not long ago a Beaufort found a 5,000-ton German supply ship off the coast of Norway and dived to the attack. He went so low that one of his aerials was entangled in the ship's rigging and was torn off. At least one of his bombs, and perhaps the whole salvo, hit the ship, and before the Beaufort left for home the crew saw that the ship was low in the water and that there was a cloud of brownish smoke hanging over it.

On various nights a few German bombers have visited different parts of Great Britain (Belfast has been left alone for some time) and dropped a few bombs. Damage has been slight, but there have been some casualties. This quiescence is not expected to continue when (and if) things grow quiet on the Russian front.

R.A.F. raids by night and sweeps by day have been kept up with fair regularity. The German Commander

RED PILOT. A Soviet test pilot, one of the officers of the Russian Military Mission now in Great Britain, seen at the controls of a Stirling.

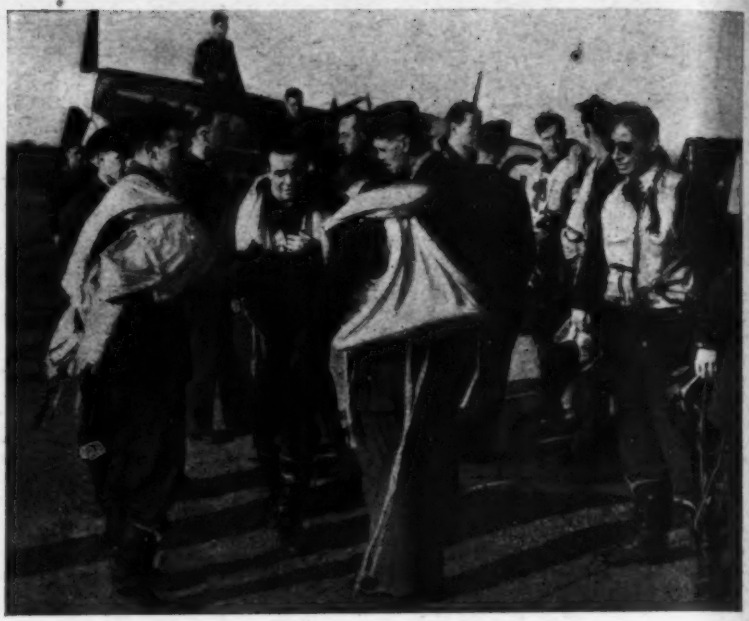
WAR IN THE AIR

in occupied France has issued an order that any man helping British airmen who descend by parachute or are forced to land will be shot without trial, while women will be sent to a concentration camp in Germany. Our men certainly show a great distaste for landing in France, and when their machines are damaged make for the Channel and try their utmost to coax the aircraft home, preferring to risk having to come down in the water. There have been some sensational rescues.

Two fighter pilots picked up safe from the sea owe their lives to the keen sight and enterprise of a Canadian sergeant. The sergeant was one of an escort of fighter pilots which went out with a rescue service aircraft to look for a pilot reported down in the Channel. Fifteen miles from the English coast he saw a patch of oil, in the middle of which was a pilot floating in his "Mae West." The Canadian signalled to the rescue aircraft, which dropped a rubber boat. The pilot swam to it and climbed in.

The Canadian sergeant left the others to watch over the man in the water and set off to guide rescue boats to the spot. While doing this he saw a second pilot in the water, floating in his one-man dinghy. He guided the rescue boats to this man. They picked him up and then, thinking their work was finished, turned and sped for England. The Canadian tried to make them turn back. He flew low over them, he waggled his wings and he let his undercarriage down. But still he was not understood. Finally, in desperation, he fired a burst from his gun into the water in front of the motor boats. That did the trick. The boats turned, and the sergeant guided them to the pilot still awaiting rescue.

A LIVE "STICK." A large force of British paratroops are now ready for action. Here are some of our "tough guy" volunteers making a practice descent.



AFTER THE SHOW. This group of Australian fighter pilots have just returned from one of the biggest daylight operations over enemy-occupied territory since war began. The squadron's bag was six "certain" and two "probables."

The Battle of the Mediterranean

IN the Mediterranean the great struggle goes on between the enemy's attempts to reinforce Libya and our attempts to stop the process. In its way this is not unlike the Battle of the Atlantic, with the rôles of the two contestants reversed. One difference is that in such narrow waters we cannot use surface raiders to any extent, but must rely on submarines and attacks from the air. Torpedoes, either from submarines or from naval T.S.R. machines, are most effective while the convoys are in transit, while bombs have to be used when they reach port. R.A.F. bombers also have shots at the moving convoys on occasions, and they, too, do damage. In one of these bomber raids one large schooner received several direct hits, and the crew immediately abandoned the ship, which was left a mass of flames. Another schooner, after being hit, blew up with such terrific force that one of our aircraft making the attack was destroyed by the blast. The harbour works at Benghazi, Bardia, and Tripoli must be in a somewhat sorry condition by now, and will give our engineers a good deal of trouble to put into good working order when we reoccupy the places. One can almost find it in one's heart to sympathise with the feelings of an Italian soldier (it is harder to feel pity for Germans) who is ordered to embark from a Sicilian port for Tripoli. They cannot be exactly exuberant.

A vivid account of a raid on Tripoli has been given by a Wing Commander who led a dawn attack on enemy shipping in Tripoli Harbour and returned again at dusk the same day and carried out a daring attack on an enemy war vessel. Both attacks were made from a few feet high. The morning attack was pressed home through a hail of *flak* from all angles, but direct hits were made on a liner of more than 20,000 tons, and an 8,000 ton supply ship. The Wing Commander, describing his second raid, said: "We flew along the Tripoli coast just after the sun had set. Twilight had nearly gone. We saw about a couple of miles off the mole two warships—one either a small cruiser or a large destroyer, and another a destroyer—silhouetted against the sky. The larger vessel was playing searchlights on the water on the far side from us as we approached. We flew towards her at less than a dozen feet. We let go our bombs from

WAR IN THE AIR

short range and the air gunner sprayed her decks from stem to stern. Sparks flew from the deck as I pulled up above the ship's masts. The whole salvo had struck amidships just below the funnel, and as I turned away the observer saw the bombs bursting in the ship. The destroyer opened fire on us with light *flak* immediately after the attack. When we were 300 yards away all lights went out on the bombed ship. We headed homewards and from ten miles away, flying at sea level, we could still see columns of smoke rising from the warship."

Italian Civilians and Airmen

ITALIAN civilians do not seem to bear any ill-will towards the R.A.F. They know that our bombers only go for military targets and do not machine-gun helpless women and children, as Italy's allies are so fond of doing. A bomber pilot who took part in a successful raid on munition factories at Licata, Sicily, has described how people on the ground waved up encouragingly as the aircraft passed a few feet over their heads. "There was heavy rain and cloud down to sea-level on the way to the target," said the pilot, a South African Squadron Leader who holds the D.F.C. "But fortunately it cleared up just before we reached Sicily. About ten miles off shore we flew over a fleet of fishing vessels. Nearly all the crews stood up and waved cheerfully. We were only about five feet above them. It was the same over fields in Southern Sicily. Some of the people waved and others looked up showing no concern, although I saw a few getting behind haystacks. I think they have learned that we do not machine-gun civilians."

But Italian airmen who have reached Libya are sometimes very exuberant. Recently it was announced that the Silver Cross for Valour had been awarded to Lt. Col. Bozano, who commands an Italian fighter wing. The award, as announced from Rome, was made following an air battle between "twenty-seven Italian fighters and fifty Hurricanes and Tomahawks." The Italian version stated that the outnumbered Italians "fought with such supreme skill and daring under Bozano's leadership that they shot down at least fourteen British fighters, completely discrediting the power of Hurricanes and Tomahawks in the Western Desert."

Truth is Stranger

THE true version was given by a fighter squadron of the South African Air Force. Its pilots say that when their squadron gave battle to the Italians, who made a sudden attempt to strafe a forward landing ground, ten Tomahawks and no Hurricanes took off, some going into the fight with their undercarriages still down, less than 100ft. from the ground. Seven Italian fighters were shot down, and not one of the South African fighters was damaged.

The R.A.F. offensive sweep over Northern France on Saturday last produced fierce fighting. Our fighter escort saw the bombers through, and the latter bombed the railway centre at Amiens and a junction near La Bassée without loss to themselves. But their escort was heavily engaged by the defending fighters and, as usual, the R.A.F. men had the best of it. The Germans lost 21 fighters, while the R.A.F. lost only 13 machines, and three of the pilots were rescued.

In the Mediterranean it has been the usual custom to leave the targets in Sardinia to the care of H.M.S. *Ark Royal*, which is based on Gibraltar, but last Saturday the R.A.F. Middle East bombers staged a raid on Elmas in the Italian island. Besides bombing the base and aerodromes, the R.A.F. severely damaged a large number of seaplanes on the water. That will circumscribe the enemy's scouting efforts for some little time to come. Other Italian seaplanes were damaged in a raid on Marsala, in Sicily.

The attack on Italian and German shipping has been kept up. A medium-sized merchantman was set on fire in the harbour of Taranto and Palermo and Bardia harbours were bombed on the same night.

ENEMY AIR LOSSES TO SEPT. 27

	Over G.B.	Western Europe	Russia (by R.A.F.)	Middle East
Sept. 21	0	24	0	0
" 22	0	0	0	0
" 23	0	0	0	0
" 24	0	0	7	1
" 25	0	0	0	0
" 26	0	0	0	0
" 27	0	21	2	1
	0	45	9	2

Totals: West and Russia, 5,421; Middle East, over 2,125.

STEPPED UP. Not only in this formation, but in fire power, for these are Hurricane IIs, with four 20 mm. shell-guns.

LAST FLIGHT. This is the Me 109F of Ober-Leutnant Reinhardt Hein, commander of a German squadron, brought down by Soviet A.A. fire. Hein, who was taken prisoner, was an "ace" of high standing in the *Luftwaffe*.

BRITISH AIR LOSSES TO SEPT. 27

	Over G.B.		Western Europe		Russia	Middle East
	A'crft	B'brs.	Ftrs.	Pilots	A'crft	A'crft.
Sept. 21	0	0	13	11	0	2
" 22	0	0	0	0	0	0
" 23	0	0	0	0	0	1
" 24	0	0	0	0	1	5 (2 pits. safe)
" 25	0	0	0	0	0	0
" 26	0	1	0	0	0	0
" 27	0	0	14	11	0	5
	0	1	27	22	1	13

Totals: West and Russia, 2,781; Middle East, about 405.

FLIGHT LOADING CONDITIONS

The "Flight Envelope" Method of Specifying Stressing Cases : Simplifying Design Requirements and Stress Analysis

THE Civil Aeronautics Board of U.S.A., in overhauling its airworthiness requirements, has considered a possible new method of specifying the various conditions of flight for which the stresses in the airframe must be analysed. This new way of setting out graphically the basic flying cases may be called the "flight envelope" method, and it seems to owe its conception to the diagrams obtained from the *V-g* recorders carried on transport aircraft for investigation of gust-loading encountered during ordinary airline flying.

The *V-g* recorder is an instrument designed to give a continuous trace of simultaneous values of the aeroplane's forward speed (V), and the acceleration (usually measured normal to the flight path, designated rather loosely g). The airspeed indicator is arranged so as to give a horizontal movement to the pointer while the accelerometer moves it vertically.

Fig. 1 shows a *V-g* record obtained during diving tests with a Beechcraft. Load factors are indicated vertically and airspeed horizontally. In straight and level flight (which is unaccelerated) the load factor is 1 though acceleration is zero. But if the aeroplane is being accelerated upward at the rate of 1g (which is 32ft. per sec. per sec.) its load factor is plus 2. Load factors and accelerations in terms of g are not the same, the load factor always being one more than the acceleration. It can be noticed on the trace that the needle normally lies on the "1" line of the load factor scale. A pull-out from a dive or an up-gust raises the load factor above one; conversely, putting the nose down into the dive or encountering a down-gust reduces the factor below one and may even make it negative. At a load factor of 0 (acceleration of 1g downward) the pilot is just leaving the seat and his apparent weight on it is zero.

Fly Slowly in Bumps

As has been said, the *V-g* recorder records both load factor and forward speed; or more simply still, it may record dynamic pressure on the open tube of the pitot head, that is, $\frac{1}{2}\rho V^2$.

Load factor is given by:—

$$n = \frac{Lift}{Weight} = \frac{C_L(\frac{1}{2}\rho V^2)}{W/S}$$

so if load factor (n) and dynamic pressure ($\frac{1}{2}\rho V^2$) and wing loading (W/S) are known, the lift coefficient (C_L) is known. Knowing this, the complete picture of flight conditions is known, angle of incidence, position of centre of pressure, and drag coefficient. Obviously, accelerometer readings alone are not at all informative. Such readings give the load applied, but, since c.p. position is unknown, there is no information as to the distribution of the load. Also, by use of the "sharp-edged gust" and the other assumption that the aerodynamics are the same as for steady flow, the increment of load factor due to a vertical gust of velocity U is given by:—

$$\Delta n = \frac{\rho a UV}{2\ W/S}$$

in which a is slope of lift curve.

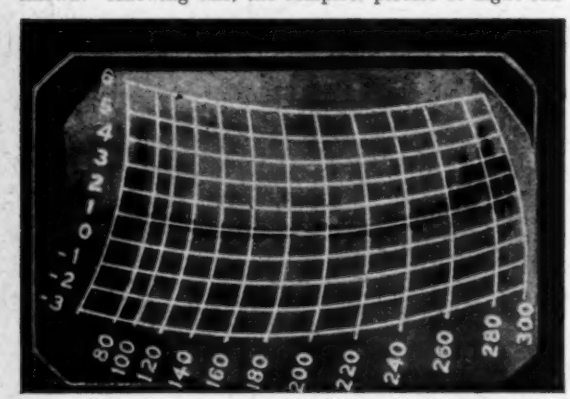


Fig. 1. Actual trace obtained on a *V-g* recorder installed on a D17S Beechcraft for diving tests. Load factors are given vertically, airspeed horizontally.

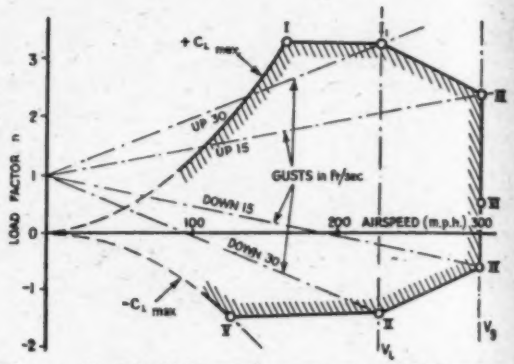


Fig. 2. On this flight envelope are set out the various American structural strength requirements (cases I to VI). A vertical line on the diagram represents a speed, while a gust is represented by a straight sloping line drawn from the load factor = 1 point. V_L is level flight speed and V_g is maximum gliding speed.

This shows why aeroplanes should be flown slowly in bumpy weather to reduce load factors.

All this is incidental but throws much light on why the C.A.B. has considered the use of the "flight envelope." It gives a graphic picture of the conditions for which the aeroplane is designed. Fig. 2 shows the American design requirements set out on such a diagram of the *V-g* type. It will be noted that a gust can be represented as a straight line drawn from 1 on the load factor scale. In Report No. 4, "Flight Loading Conditions,"* the objects of the flight envelope are given as:—

1. To place the flight requirements on a general basis and thereby eliminate many arbitrary conditions from the regulations.

2. To enable the commercial flight requirements to be more directly compared with foreign and military requirements.

3. To assist in establishing a closer relationship between aeroplane strength and flight limitations.

4. To simplify the stress analysis procedure.

All these are objects worthy of attention, particularly 3 and 4. The Board has noticed, from accident study, that there is a growing tendency to use small commercial aircraft in aerobatics more violent than those for which they were designed. It wonders whether the establishment of an acrobatic category (as there has always been under British requirements) may be necessary, and in any case feels that more should be done towards informing pilots of the strength limits of their aeroplanes.

The ease with which one can analyse and criticise requirements thus set out graphically shows how valuable

*Air Commerce Bulletin, 15th Sept., 1939, p. 78.

FLIGHT LOADING CONDITIONS

the envelope is. The report goes on to analyse the "tapering" of the diagram to the right, or high-speed, end. This is equivalent to providing for a lower gust velocity at higher aircraft speed and seems logical enough for civil aircraft, as a good pilot will reduce his speed if encountering very severe vertical gusts. (For a military dive-bomber it would not be logical as he might still have

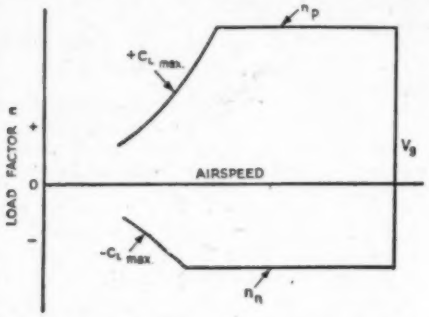


Fig. 3. This is a simplified type of flight envelope. Its boundaries are determined by five factors: upper and lower by maximum positive and negative load factors (n_p and n_n), at the right by design gliding speed (V_g), and at the left by maximum positive and negative lift coefficients ($C_{L\,max}$ and $-C_{L\,max}$).

to resist the effect of a severe bump when in a fast dive.) But there is an objection to the "tapering" for even a civil craft, as manœuvring loads must be resisted. Even to keep the load factor constant a pilot must use his controls more gently at higher speeds, and, in fact, one might think it necessary to provide even higher factors at higher speeds. But a constant load factor (i.e., straight horizontal lines for both top and bottom of the diagram for normal and inverted flight) seems a reasonable compromise and allows a very simple notice of maximum accelerometer reading to be placed on the dashboard of aerobatic aircraft—if it ever becomes necessary to install accelerometers and notices to protect the more daring aerobatic pilots. Maximum gliding speed is, of course, given by the vertical line at the right. This is seen in Fig. 3, the suggested type of envelope. The outline of such an envelope would be determined by five factors:—

N_p, maximum positive load factor (the greater of manœuvring and up-gust factors).

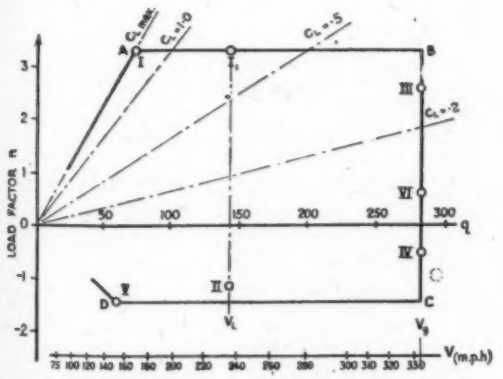


Fig. 4. This type of flight envelope, the n-q type, is plotted on a base of dynamic pressure instead of airspeed. It can also have airspeed plotted on a non-uniform scale, as shown at the base of the diagram. American strength cases I to VI are indicated.

N_n, maximum negative load factor (the greater of inverted flight and down-gust factors).

V_g, design gliding speed.

$C_{L\,max.}$ maximum positive lift coefficient.

$C_{L\,max.}$ maximum negative lift coefficient.

Dynamic Pressure Base

Out of the diagrams previously mentioned develops the n-q diagram, with load factor plotted against dynamic pressure ($\frac{1}{2}\rho V^2$) instead of speed (V). This is more useful for stress analysis work, as using $\frac{1}{2}\rho V^2$ eliminates any doubt as to whether "true" an "indicated" airspeed is meant. Also, all lines representing conditions at constant C_L are straight lines (see Fig. 4). Another advantage is that the boundaries include all the critical loading conditions; that is, no point inside the envelope can be more critical than a point on the boundary. Further, the four corners of

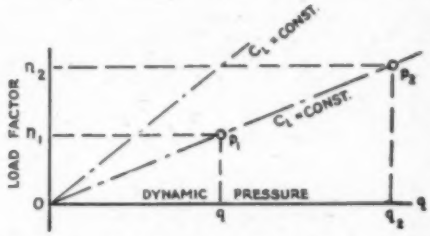


Fig. 5. If dynamic pressure is used for the base instead of airspeed, lines of constant lift coefficient are straight and consideration of altered load factors and flight conditions is simplified.

the boundary will generally provide critical conditions for modern structures.

The application of the n-q envelope to stress work is given more fully in Report 5 †, in which it is pointed out that lines of constant C_L represent conditions in which all loads on the aeroplane remain in proportion. If, for in-

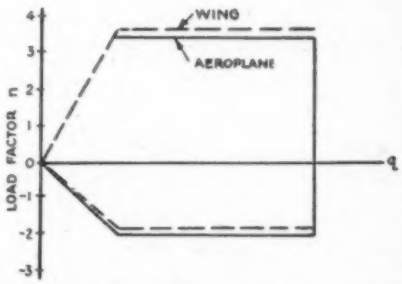


Fig. 6. This diagram illustrates the difference between flight envelopes for the "aeroplane" and the "wing."

stance, point p_1 (Fig. 5) represents a safe flight condition for a certain structure, and the strength of this structure is subsequently doubled, the new safe condition will be found at p_2, which is determined by $n_2 = 2n_1$ and $q_2 = 2q_1$. This feature may be used in determining the limiting flight envelope for a structure.

So far, only "aeroplane" flight envelopes have been considered. But it will be realised that *aeroplane* load factors are not necessarily *wing* load factors. If the "aeroplane" load factor on flying into a gust is 2, the "wing" load factor may be slightly different from 2, since aerodynamic condition and, therefore, tail-load, are altered. So "wing envelopes" can be obtained from "aeroplane envelopes" by determining the balancing tail-load and making suitable adjustments. Fig. 6 shows the adjustment made. As for using envelopes for the specification of design requirements, the report favours the use of the

† *Air Commerce Bulletin*, 15th Oct., 1939, p. 111.

FLIGHT LOADING CONDITIONS

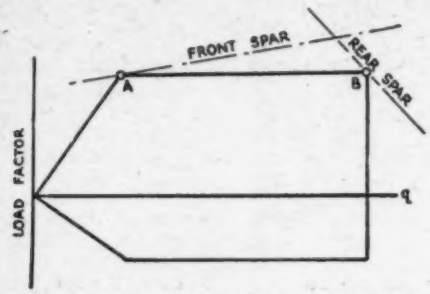


Fig. 7. "Strength lines" for particular components of the aeroplane structure may be shown on flight envelopes and this diagram shows such lines for front and rear wing spars.

"aeroplane" type, that is, acceleration load factors and not "wing" factors. This would be in accordance with British practice which, for example, in the C.P.F. case with factor N, requires that the aeroplane shall be balanced out for a load of $\frac{NW}{2}$ (that to be actually experienced in flight) acting through the centre of gravity and then all loads shall be doubled (to provide the factor of safety) for the purpose of finding the minimum failing loads of members.

"Strength lines" of various structural components such as spars can be plotted on the diagram. If spars of a two-spar wing, these lines will be straight if the loads due to drag are small enough to be neglected in comparison with those due to lift. Fig. 7 shows such a diagram with front spar designed for one corner condition (C_{Lmax}) and rear spar for the other corner (maximum gliding speed). This diagram becomes a "strength envelope," and the method may even be applied to stressed-skin structures, though not so readily as to two-spar wings.

It will be seen that the method of the flight envelope is useful for examining the question of compliance of any particular aircraft design with any set of airworthiness requirements and for examining increases in weight and speed.

Perhaps the post-war future will see an attempt at obtaining international agreement about the design strength of aircraft. This method may then be useful for visualising and reconciling the conflicting national requirements.

EMPIRE AIR SCHEME PROGRESS

Canadian Minister for Air Announces Revised Estimate of Cost : Over 50,000 in R.C.A.F.

NEGOTIATIONS for the extension of the Empire Air Training Scheme with the United Kingdom, Australia and New Zealand will be initiated shortly and on a new accounting basis, Hon. C. G. Power, Canadian Minister for Air, announced recently after returning from conferences in London. Asked if this is an indication that the authorities expect a long war, the Minister replied that it is necessary to plan at least 18 months in advance. Mr. Power also made some other announcements:

1. The percentage of Canadian-trained air personnel granted commissions will be increased for air gunners and wireless operators, and remain as at present for pilots.

2. A second R.C.A.F. army co-operation squadron will shortly be operating with the Canadian Corps.

3. A Canadian officer will in future sit with selection boards awarding air force commissions in England.

4. Of the 13 Canadian squadrons now operating overseas, 11 are commanded by Canadians and the aim is to have all of these, and subsequent squadrons, so commanded.

5. Arrangements are being made to facilitate transmission of Canadian air force casualty lists, and to improve publicity on individual feats of Canadian airmen.

"Part of my job overseas was to Canadianise everything that has to do with the R.C.A.F.," Mr. Power said. "There was complaint that Canadians were spread all over and were out of touch with Canada. We are going to try to group them as much as possible."

£185,000,000

This does not mean that Canadians would be taken out of the Royal Air Force if they wanted to stay there, or to prevent Canadian Air personnel going into the R.A.F. Members of the R.C.A.F. serving with the R.A.F. are paid at the rates paid by the latter service, but the difference beween that and the Canadian rates is made up to them in deferred pay.

As the senior member of the group of governments co-operating in the air training scheme, the United Kingdom would initiate the negotiations for renewal of the three-year agreement reached in April, 1940, the Minister said.

Cost of the scheme up to March 31, 1943, now is estimated at $824,000,000, of which Canada will contribute $531,000,000. (The Canadian dollar stands at about $4.45 to £1, so these amounts represent £185,000,000 and £119,000,000.) When the plan was launched at the start of the war the estimated cost for a three-year operation starting April 1, 1940, was placed at £135,000,000 with Canada's share £79,000,000. Since then various estimates of increased cost ranging up to £225,000,000 have been made, but Mr. Power said a more precise estimate now was possible. The total is divided as follows:

United Kingdom contribution in aircraft, engines and parts, £44,000,000; Canada alone, recruiting and manning depots, initial and elementary training of Canadian pupils, £27,000,000; shared by Canada, Australia and New Zealand, advanced training, £115,000,000. Of the £115,000,000 Canada's share is 80.64 per cent., or, roughly, £92,000,000; Australia's 11.28 per cent. or £13,000,000, and New Zealand's 8.08 per cent.. or £9,000,000.

American Scheme Not Included

The estimate, Mr. Power explained, is for the three-year period of the air training agreement and is based on the assumption that the plan ends with the agreement which, of course, is unlikely unless the war has ended by then. Even if it did end then an additional £6,000,000 would be needed to complete the training of pupils in the advanced schools. Mr. Power said he had no information about the establishment of British air training schools in the United States, which he understands is a direct arrangement between the Governments of the two countries concerned. "This will not diminish in any way the scope of the Air Training Scheme, which has already gone beyond anticipation in that we have more schools than we expected," he said. In addition to the money they are spending in Canada, Australia and New Zealand carry on training at home. The £27,000,000 spent by Canada on recruiting, elementary and initial training has its counterpart in the money spent in Australia and New Zealand to train recruits there. In addition, Australia does advanced training and all the Australian output of air personnel does not go through Canada. Some goes directly overseas to Australian squadrons in the war areas.

Of the £142,000,000 to be paid in cash by Canada and shared between Australia, New Zealand and Canada, it is estimated that £56,000,000 will be spent in the current fiscal year. This subdivides as follows: Pay and allowances, £15,000,000; aircraft engines and parts, £14,000,000; aerodromes, works and buildings, £5,000,000; overhaul of engines and aircraft £4,000,000; maintenance of personnel, works and buildings and certain aircraft, £18,000,000.

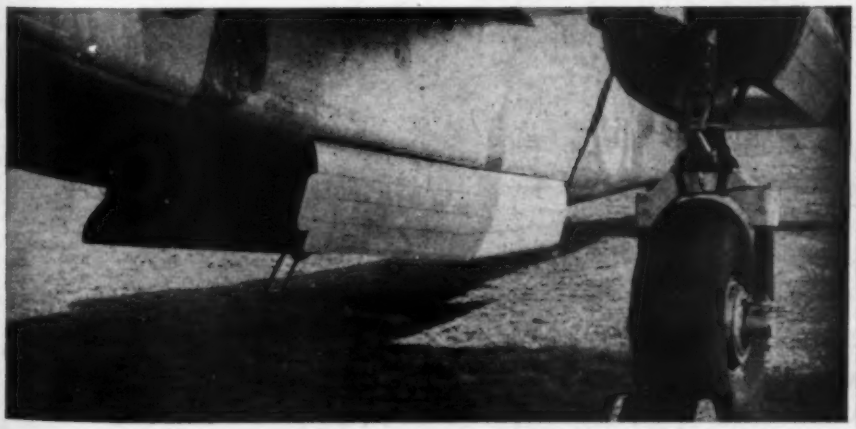
Enlistments in Canada are continuing steadily. From the start of the war up to May 14 last a total of 48,772 men, of whom 16,034 were air crew and 32,738 ground crew, enlisted in the Royal Canadian Air Force. Later, Canada's Prime Minister said that over 50,000 men were in the R.C.A.F. Both these statements were made in the Dominion House of Commons.

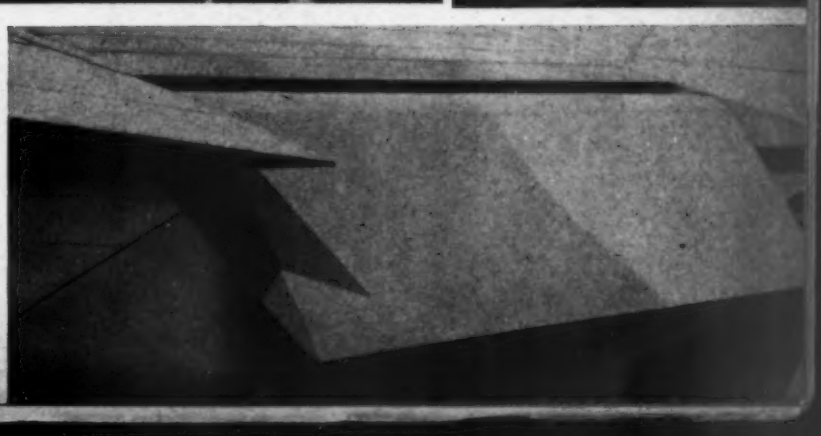
BOTHA IN PICTURES

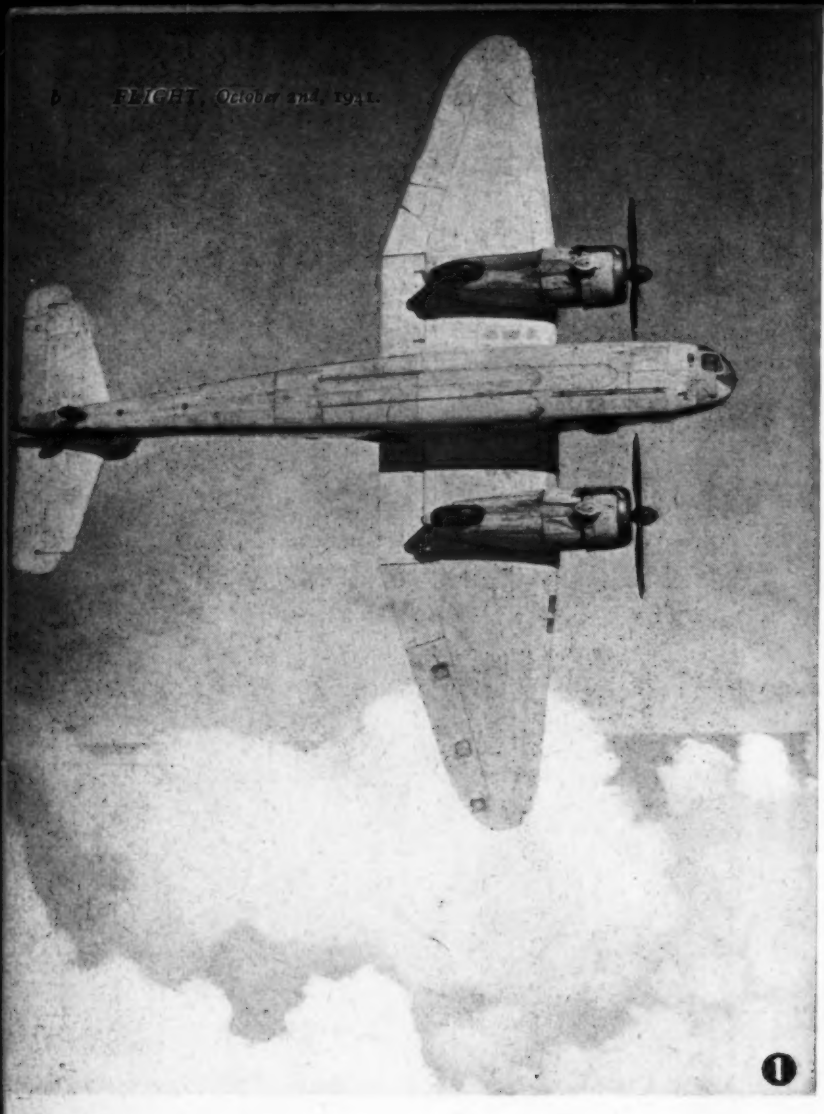
Intimate Glimpses of a Coastal Command Operational Training Aircraft

ON this and on the next three pages are a series of photographs—both ground and air shots—of the Blackburn Botha. They were taken by our Chief Photographer, Mr. John Yoxall, who was granted special facilities by the Air Ministry.

(Top, right) A glance backward from the open roof above the pilot's head. The object nearest the camera is the streamline casing of the D.F. loop aerial. (Centre, right) The door is shown both closed and open. As the door hinges downward the ladder slides automatically into position. (Centre, left) In this picture the position and size of the bomb bay can be seen. The Vokes air cleaner and the simple sturdy undercarriage leg is also shown. (Bottom, left) A close-up of the streamlined power-operated twin gun turret. (Bottom, right) The port slotted flap.







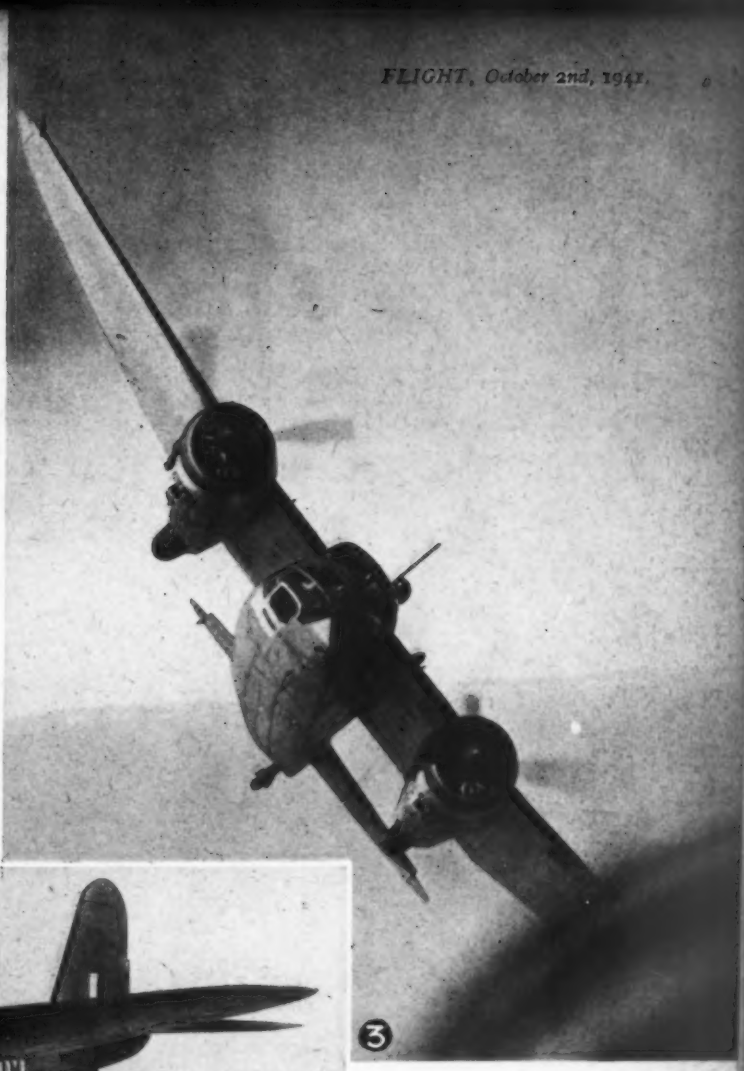
(1) That the Blackburn Botha is very manœuvrable is shown to advantage in this picture of the start of a half roll and dive out to normal attitude.

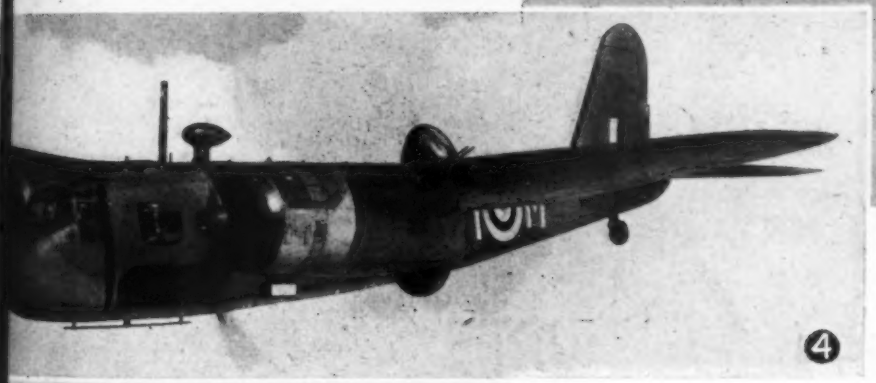
(2) A view of the Botha which makes the wing form appear to be more elliptical than it actually is. The field of fire of the twin-gun turret is also portrayed.

BOTHA IN PICTURES

A Flight Lieutenant with the D.F.C. Puts a Blackburn Botha Through Its Paces for "Flight's" Camera

(6) In this view the bomb-aimer's panel, the sea-behind blister on the side of the fuselage and the neat cowling of the sleeve-valved Bristol Perseus engines are all apparent.



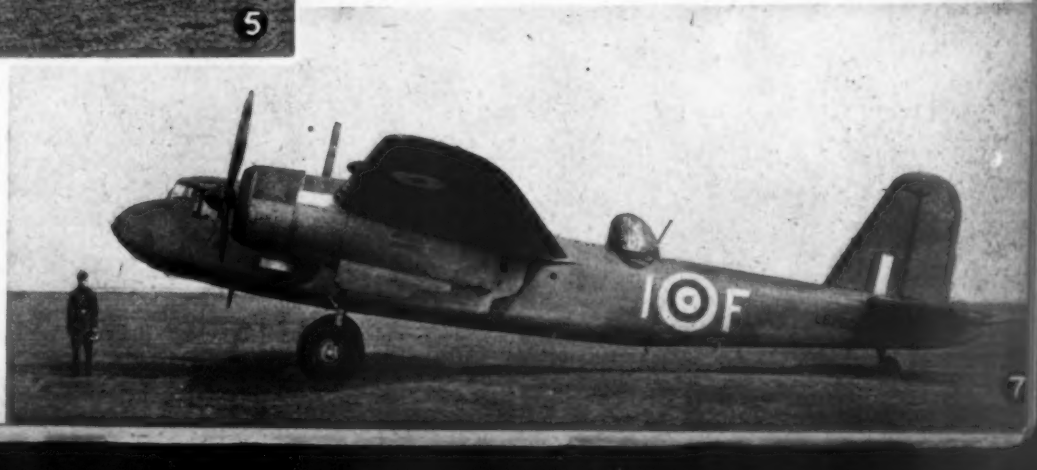


(3) The Botha is not in the twin-engined fighter class, yet, in the hands of a capable pilot, it can be very agile.

(4) A three-quarter front view which shows the wireless mast, the landing lights in the port wing and the cooling gills, for the Bristol Perseus engines.

(5) Blackburn Botha on an aerodrome with some of the staff of Brooklands Aviation Ltd., who are responsible for their maintenance. The figures help to give an indication of the Botha's dimensions.

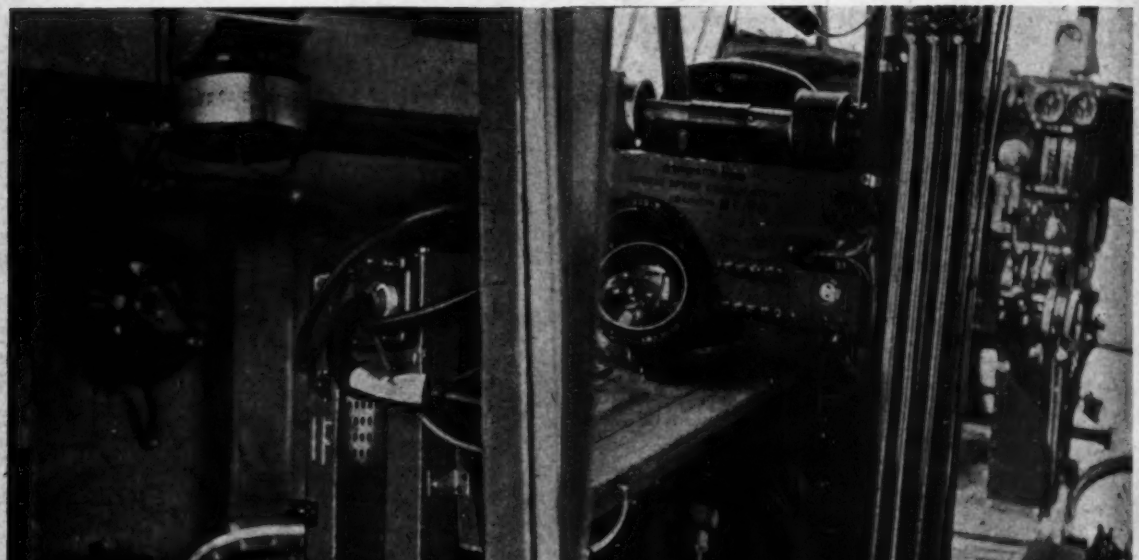
(7) Seen from the side the Botha is a very shapely aircraft, although the turret does break the body line somewhat. De Havilland metal - bladed variable - pitch airscrews are fitted.

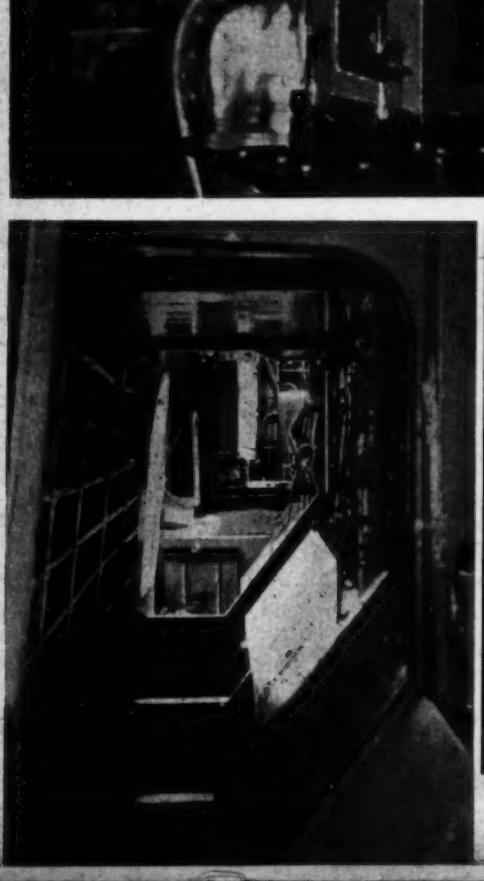


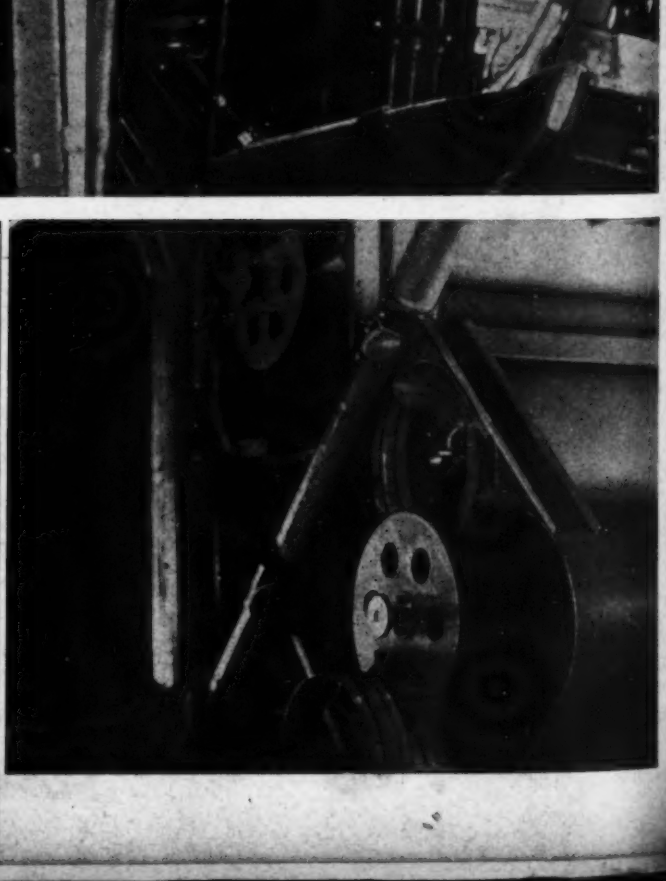
BOTHA IN PICTURES

Some Interior Views

(Top, right) The bomb-aimer's position on the right of the pilot. (Centre, left) A peep into the radio operator's compartment. The direction-finding loop aerial control can be seen in the ceiling. (Centre, right) With chart table, bubble sextant and other paraphernalia the navigator's cubby hole is between the pilot and the radio operator. (Bottom, left) The starboard side of the fuselage, looking aft. Circular openings in the inclined panel allow access to the bomb bay during flight. (Bottom, right) Flare stowage.







Sixth of the New Series

FRIEND or FOE ?

Two Opposite Numbers With Distinctive Tails

WESTLAND LYSANDER
Cantilever tailplane set low on fuselage, pronounced backsweep to leading-edge, rounded tips. Large fin and comparatively small rudder area clear of elevators. Fixed tail wheel.

ALTHOUGH the Westland Lysander is a familiar sight in this country—and the easiest of all British machines to identify—it is just possible that future events might bring its German counterpart, the Henschel Hs 126, over these shores with sufficient frequency to lead to possible confusion between these two army co-operation types.

As is already well known to most of our readers, the Hs 126 greatly resembles our own Lysander in its general layout (very naturally so, since it was designed for similar functions), both being strut-braced, high-wing monoplanes with fixed undercarriage legs and radial engines. It has, of course, a number of informative differences when viewed from any angle, and one of the most readily discernible is its tailplane, which is not only quite distinctive in plan view, but is very differently mounted from that of the British machine. This latter point of divergence is particularly useful to the spotter because there is not a very great deal of difference between their respective fins and rudders in the matter of actual outline, which leaves the tailplane as the quickest and most positive means of confirming identity.

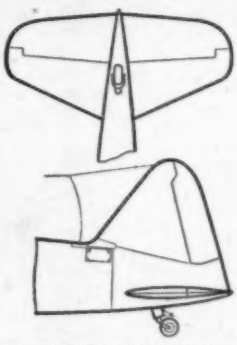
The accompanying pictures and drawings clearly illustrate the completely different tailplanes of the Lysander and the Hs 126. That of the British machine has a pronounced taper to its leading-edge and a slight one to its trailing-edge and is of comparatively low aspect-ratio. The Henschel tailplane, however, has straight and parallel edges and semi-circular tips, with a "bite" in the trailing-edge where the elevators are cut away to permit rudder movement. The Lysander's rudder, however, being completely above the elevators even when the latter are fully raised, does not require a "bite" in the trailing-edge of the horizontal surfaces.

The difference in the manner of mounting the two tailplanes is just as marked as is the difference in their respective outlines. That of the Lysander is of cantilever construction and is set very low on the extremity of the fuselage. The Henschel tailplane, however, is mounted about half-way up the fin and is externally braced by double struts.

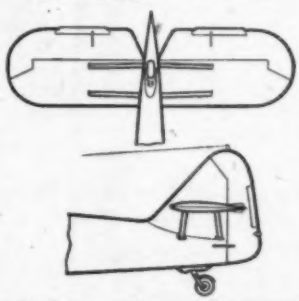
Turning finally to the respective vertical tail surfaces of these two machines, the illustrations show that no very marked difference exists. The Lysander, however, has a more pronounced slope to the trailing-edge of its rudder, and the total area is somewhat larger and broader across its base-line than in the case of the Henschel. If conditions are such that details are visible, it will be seen that the rudder of the British machine is wholly above the extremity of the fuselage, whereas that of the German extends down between the cut-away elevators to blend into the base-line of the fuselage. The area of movable rudder in relation to the area of the fixed fin on the Lysander is appreciably less than in the case of the Henschel, but the total area of the vertical surfaces is greater on the British aircraft. It will also be noted that trimming tabs are dispensed with on the Lysander, but are present on both elevators and rudder of the Hs 126—a minor detail of purely technical interest to the student of design rather than to the spotter. Both machines have fixed tailwheels.

Next week: Lockheed Lightning and Focke-Wulf 189.

LYSANDER



HENSCHEL Hs 126



HENSCHEL Hs 126. Double strut-braced tailplane, with straight parallel edges and rounded tips, set half-way up fin. Vertical surfaces somewhat similar to Lysander but smaller. Rudder extends down between elevators to base-line of fuselage. Less slope to leading- and trailing-edges than Lysander. Fixed tailwheel.

The Ideal Trainer

Can Design be Improved? : Three Side-by-side Cabin Types Compared

By Ex R.F.C.

THE amount of effort put forth by both instructor and pupil and the time expended in raising the pupil to the required standard of ability in elementary flying are both affected by the excellence of the aircraft used. Elementary trainer design is, therefore, an important subject and, though we are well provided with trainers, a survey of the requirements of design is never out of place.

The great majority of trainers in use, as most people will know, are light biplanes with engines of about 130 h.p. The type is, broadly speaking, common to most countries. It is characterised by reliability, sturdiness, reasonable ease of maintenance, and viceless simplicity of control. All the makes were, however, designed nearly ten years ago and one is bound to wonder if our progress in design has been so slow in the intervening period that these machines, with a few minor improvements recently added, are all that can be desired. It is true that we have at least one monoplane trainer of modern conception in use in our schools, and it is also true that our most generally used biplane trainer is an excellent little aeroplane; however, there is room for improvement.

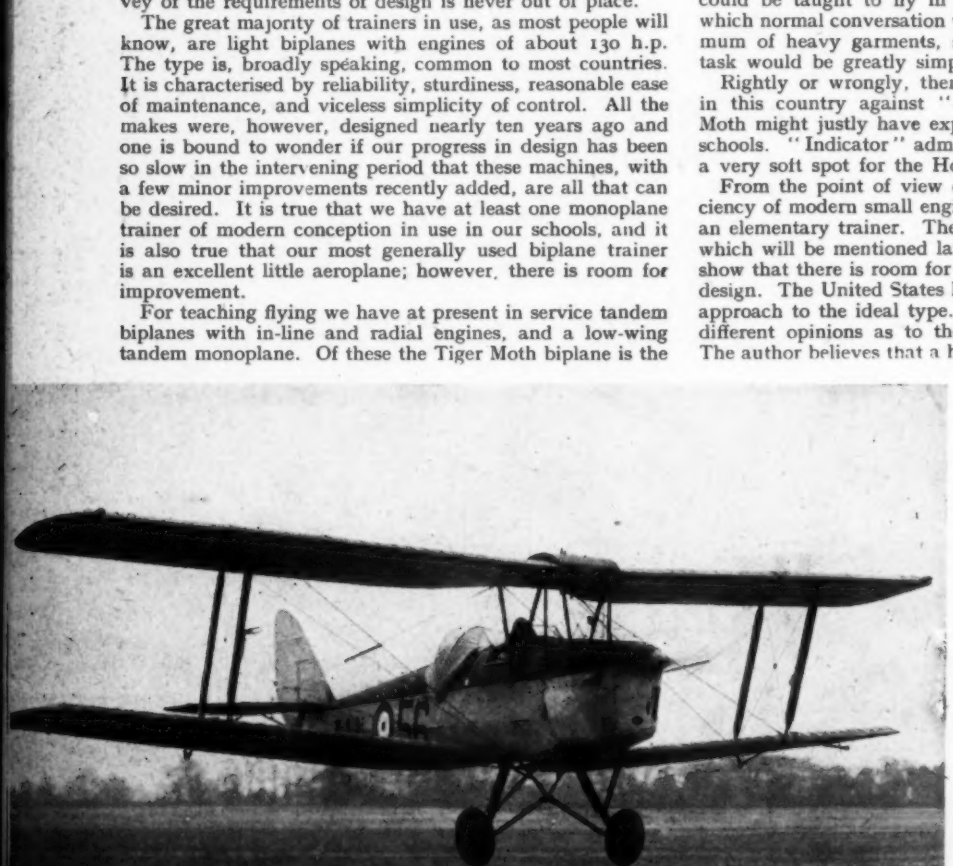
For teaching flying we have at present in service tandem biplanes with in-line and radial engines, and a low-wing tandem monoplane. Of these the Tiger Moth biplane is the best known and most widely used. All had open cockpits. In passing, attention may be drawn to the fact that the great majority of the types for which pilots are trained are monoplanes with enclosed cockpits.

As mentioned earlier, one of the limiting factors in training will be fatigue of both pupils and instructors. If pupils could be taught to fly in greater comfort, in aircraft in which normal conversation was possible, and with the minimum of heavy garments, straps, tubes and the like, the task would be greatly simplified.

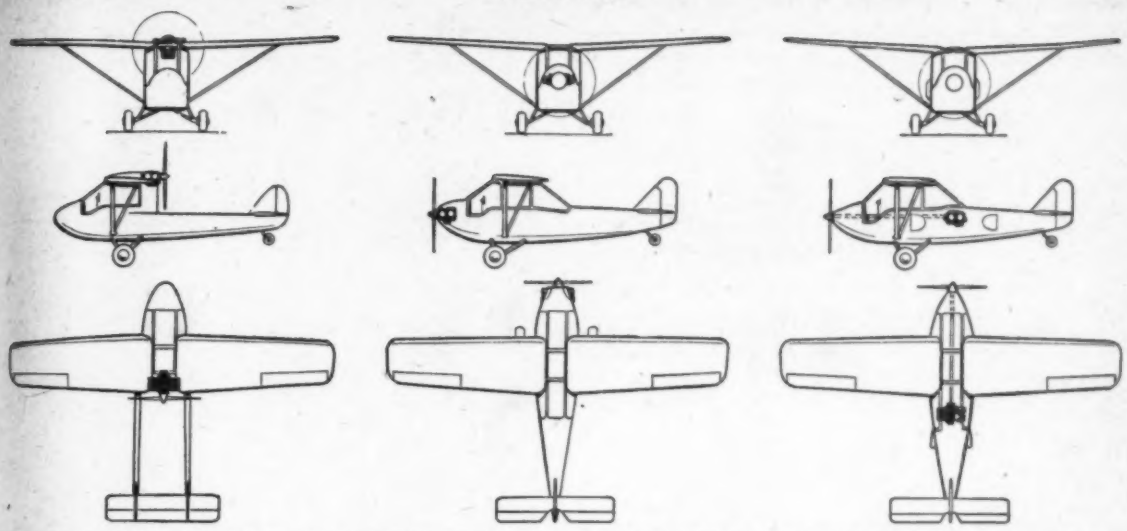
Rightly or wrongly, there seems considerable prejudice in this country against "cabin trainers." The Hornet Moth might justly have expected a better reception in the schools. "Indicator" admits (or some time ago admitted) a very soft spot for the Hornet.

From the point of view of the nation's pocket, the efficiency of modern small engines makes 90 h.p. adequate for an elementary trainer. There are other possible economies which will be mentioned later. Sufficient has been said to show that there is room for a small trainer of more modern design. The United States have probably made the nearest approach to the ideal type. No doubt there will be many different opinions as to the layout for this ideal trainer. The author believes that a high-wing cabin monoplane with side-by-side seating and an engine of about 90 h.p. would form the basis of the ideal type for present requirements. It may transpire later that tricycle undercarriages, slots, etc., or even some form of helicopter may so revolutionise flying that trainers will require entirely different characteristics or even be rendered unnecessary.

There are many *pros* and fewer, less important *cons* in connection with the above basic specification, some of which, for the sake of clarity, may be roughly tabulated.



STANDARD TRAINER: Every Royal Air Force pilot will remember his training days when he sees a Tiger Moth.



A PILOT'S IDEAS OF DESIGN : Our contributor expresses a strong preference for the cabin type of elementary trainer, and here shows three layouts which appeal to him. He regards side-by-side seating as essential.

In favour (side by side cabin):—

1. It is a great advantage to be able to observe the movements and even expressions of an *ab initio* pupil and for him (or her) to be able to see the instructor. The holding and operation of controls and reactions to manœuvres can all be gauged more positively. The pupil will gain confidence by being able to see that he has full control of the aircraft when the instructor says so. Pupils at first find this hard to believe in a tandem machine.

2. A roomy and warm cockpit is possible without much difficulty to the designer. (Comfort and space are most important in making the pupil feel at ease, thus making for more complete concentration and reduced fatigue.)

3. Direct normal conversation without the irritation of shouting through tubes and without the expense or encumbrance of speaking tube, mouthpiece and helmet.

4. Simpler explanations of instruments, maps and so forth, in the air, and a certainty of co-ordination of readings of main flying and engine dials, the majority being common to both instructor and pupil.

5. No duplication of instruments. (Arising from this are considerations of expense, drain on service stocks, complication and weight.)

6. Elimination of need for special flying clothing.

7. Ability to deal directly with panic, accident or "freezing up" on the part of the pupil.

8. Good general visibility, and particularly forward visibility, for both pupil and instructor.

9. Reproduction of many monoplane characteristics common to service aircraft, without undue reduction of safety or manœuvrability.

10. Increased efficiency over braced biplane.

Possible disadvantages—

1. Blind side for instructor or safety pilot, particularly during practice of instrument flying, and to a lesser degree for the pupil.

2. Tendency always to make turns and other manœuvres in one direction.

3. If tandem (or single seat) machines have been flown or are to be flown, there may at first be a tendency to fly one wing low and/or with rudder applied.

4. Slight extra difficulty in getting out of a cabin machine in emergency.

5. Forming a habit of looking over one side only when landing.

6. Two nose positions to be learnt for all turns and certain aerobatics.

No doubt there are other points which might be raised, and these are certainly answers to the majority of *cons* mentioned above. Of the other faults which might be cited many will be countered when the suggested design is elaborated. For example, when grouping the instrument panel, the blind flying dials must be arranged as nearly as possible to correspond with the service blind flying panel and must be placed squarely in front of the pupil; difficulty is otherwise experienced in judging the exact position of the more sensitive needles, such as the turn needle. The instructor's more oblique view of the dials should be sufficient for his requirements. The compass, trimming device, petrol cock (and flap or air brake lever, if fitted) should be centrally disposed.

In connection with the aircraft, as opposed to its equipment, a very simple single "V" strut bracing should be sufficient for the wings. This must be so placed as to give a minimum interference with cabin doors or entrance and exit from the cockpits. The panels of the cockpit must, wherever possible, be transparent.

All main units, such as wings, tail surfaces, undercarriage legs, and engine, should be quickly detachable and interchangeable in view of the fairly frequent minor accidents which inevitably occur during early flying hours.

SIDE-BY-SIDE BIPLANE : The Blackburn B.2 was an enterprising adventure in all-metal design in pre-monoplane days.

THE IDEAL TRAINER

Even though they have certain advantages, tail skids can play such havoc with an aerodrome surface that tail wheels are probably advisable. This rather entails the fitting of brakes, but although it is essential to keep an elementary trainer as simple as possible, brakes are desirable for several reasons; not so much to familiarise a pupil with their use at an early stage as to simplify taxying and parking, thus saving pre- and inter-flight time. A brake system, while itself able to cause accidents due to nosing over, is more likely to be instrumental in preventing taxying accidents if well designed. Due to the rather wide fuselage and the deflection of airscrew slipstream from the rudder, light side-by-side aircraft without brakes are apt to be difficult to control on the ground, especially in a strong wind.

Importance of Visibility

Earlier it was stated that America had produced types similar to the ideal suggested here. In general this is true, but several drawbacks exist, an important one from the training point of view being the almost universal use of radial engines except in ultra-light types. This at once sets a problem for forward visibility, quite apart from considerations of the engine type itself.

One hardly dares to be in the least degree unorthodox in trainer design. Instructors are themselves a conservative lot. They are well used to a certain type and are rather prone to regard it as the only type possible.

It has been said that our present trainers are quite adequate for the job and, at a time like the present, a change would involve trouble, expense, and a risk of shortage of machines. There is a good deal of truth in this, but it may be assumed that our production of trainers is sufficient to enable a reserve to be built up, thus eliminating at least the last-mentioned objection; while the foregoing discussion will have failed if it does not give justification for a certain initial expenditure of money and effort to conserve just these two things in the long run. Providing one or two major problems could be satisfactorily overcome, a pusher engine has several good characteristics for application to a trainer. However, to mention in simple terms two considerations which come to mind at once: can a straightforward tail unit be designed, and what will happen to the engine—or, more important, the pupil and instructor—in the event of landing on the nose or being involved in a head-on collision?

A possible alternative to the present orthodox arrangement or the pusher would be the mid-engine arrangement with a short shaft drive. This would be something of a compromise, permitting a simple single tail, good visibility, and no fear of an engine "in the back of one's neck" in the event of a collapsed undercarriage or nose-over.

The side-by-side cabin of the De Havilland Hornet Moth made it a very popular machine and it conforms to some of our contributor's ideas.

The time for a tricycle trainer has not yet arrived, in my opinion. Tricycle undercarriages in service are still few and far between, but, one hears, show excellent promise. It may be that in a year or two we shall have to discriminate at the elementary stage between bomber and fighter instruction. Recently the flying characteristics of these two types have diverged more and more. It is not suggested that, say, the Bulldog and the Virginia could have been very closely compared, but they were possibly more similar than the Spitfire and Whitley. It will, however, depend largely upon fighter development, whether big twin-engined escort fighters, with manœuvrability to some extent sacrificed for speed and range, will completely oust the smaller single-engined fighter for attacking hostile as well as defending friendly bombers. The particular mention of a recently announced trainer as a trainer for night operation admittedly finds a strong pro-tricycle argument. Night flying is, however, part of the more advanced syllabus.

Method of Construction

Whatever type be chosen, the construction most suitable for the conditions of operation is the fabric-covered, welded-steel tube structure. This is reasonably light and inexpensive and lends itself readily to repair. The engine section should be metal covered. Stressed skin or any form of monocoque construction suffers the disadvantages of expense, difficulty of repair, complication of the very frequent inspections to which trainers are subjected, rather greater weight and, at the present time, unnecessary use of materials needed for service types. Wood is, of course, an alternative, but among other things, is not likely to weather too well if picketed out for long periods in all weathers.

For the most conventional of the three designs illustrated, the type with engine ahead of cockpit, a horizontally opposed four cylinder engine would perhaps be the most suitable. The engine shape would fit into a side-by-

The Ryan PT-21, with its Kinner radial of 125 h.p., is one of the standard trainers of the U.S. Army Air Corps. It is one of the very few braced monoplanes in existence.

THE IDEAL TRAINER

side cockpit without difficulty and the design is very simple to maintain.

In view of the reduction of engine power from 120 h.p. to 90 h.p., an airscrew of smaller diameter will be fitted, thus allowing the engine to be mounted relatively lower, while still giving a safe ground clearance.

Figures and characteristics for a trainer of any of the types discussed, with an in-line or horizontally opposed engine of 90 h.p., should be approximately as follows:—

Cruising speed	100	m.p.h.
Maximum speed	115	,,
Stalling speed	45	,,
Initial climb	750	ft./min.
Weight empty	850	lb.
Weight loaded	1,450	,,
Cruising duration	3½	hours
Wing span	35	ft.
Length	24	,,

For the short-shaft drive, enclosed engine version, two simple cooling air scoops for the engine would be disposed on each rear side of the enclosed cockpit. All three types should have a conventional pair of braced undercarriage legs and would carry a foot step for entry. Dual flying controls would, of course, be fitted, separate (not a single forked) control columns being recommended. Parallel acting swing rudder pedals are preferable, and these must be adjustable for reach. It has already been stated that the cockpit enclosure should be transparent where possible and simple sound-proofing arranged. An unelaborate heating system, detachable during the summer months, could be designed and a long pipe carrying the exhaust to the rear should serve as a partial silencer.

Cockpit Comfort

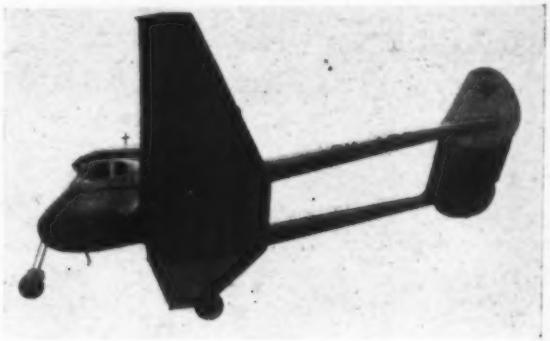
A hood for blind flying should pull forward, pram-fashion, and, when not in use, fold behind the seat without interrupting vision rearwards or sideways. The front screen should be swept low down on either side of a short nose.

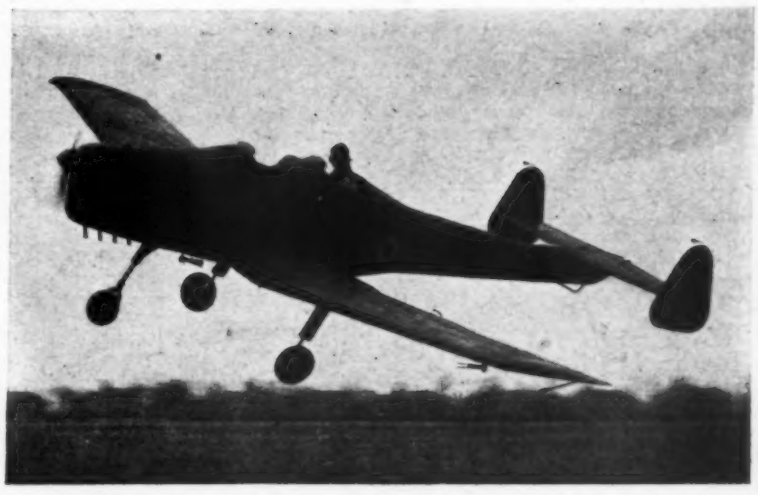
English designers have something to learn from America with regard to cockpit comfort and equipment. Without adding appreciably to weight or cost, all knobs, switches and taps should be fairly large and sensibly placed. Instruments must be well disposed and lighted, not forgetting blind flying needs. A small disappearing map table with clip should be included. Ventilation of the cockpit would need careful consideration.

A small increase in structural weight can hardly be avoided if twin tails or shaft drive are employed, but there should be no need for reduced accessibility in the case of the internal engine or for complication of design.

This article is written rather from the flying point of view than from that of the aircraft designer, and the technical side of the suggested designs has only been touched upon. It would be interesting to hear which type would be favoured by the design and production staff, and the views of the maintenance staff are very important. There may be something to learn from somewhat similar designs already in being. Of the first conventional type there are several dozen American makes to examine and compare, notably Cessna, Fairchild, Brown, Rearwin, Luscombe, Porterfield, Monocoupe and Piper. There have also been seen in this country the Czech Praga and the Wickner, while the popular Puss and Leopard Moths are certainly similar.

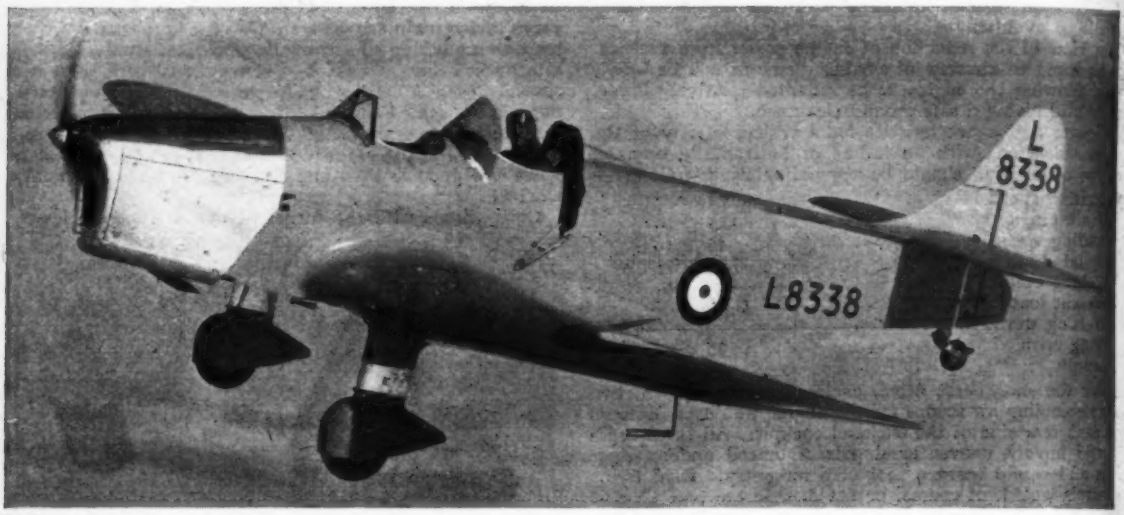
Comparisons with the suggested pusher type are fewer.





TRIO OF TRICYCLES: (Top) The Stearman-Hammond Y was an American design, but it was used by K.L.M. to train pilots for the tricycle DC-5 airliners. (Middle) The Scheldemusch (Scheldt Sparrow) was designed to take advantage of every possible safety device. (Lower) The General Aircraft Owlet is designed as a "tricycle trainer needed by tricycle bombers."

THE IDEAL TRAINER



Monoplane trainers are coming into increasing use all over the world and many Royal Air Force pilots receive all their early training on the Miles Magister.

There are, however, the Arpin, and the American Stearman-Hammond Y. Of similar layout are also the French ultra-light S.C.A.L., the American Weick and the very interesting Dutch Scheldemusch. Worthy of comment is the fact that all these rather unusual aircraft were built with a view to really good visibility and so-called "fool-proof" flying. Except for a limited number of high-powered military prototypes there are no machines, to the author's knowledge, which can be directly compared with the third design outlined above.

Figures quoted for the proposed trainers compare with an average of figures for all the above-named types.

C.P.R. IN THE AIR

OPERATIONS and organisation of the western airlines acquired by the Canadian Pacific Railways are being merged with those of the parent company. In a recent issue of the *Canadian Pacific Staff Bulletin* the following particulars are given of the company's interest in airlines:

An important unit in the new air services controlled by the C.P.R. is United Air Service Limited, of Edmonton. Last June, the schedules of Mackenzie Air Service, Limited, were co-ordinated with certain operations of Canadian Airways, Ltd., in the Mackenzie River area between Edmonton and the Arctic Ocean and on the Edmonton to Prince Albert run and placed under the operation of United Air Service, Limited.

The co-ordinated services are operated under the general direction of an advisory board composed of representatives of the Canadian Airways, Mackenzie Air Service and the C.P.R. With 13 craft in operation or on hand, United Air Service operated for 603 flying hours during June, covering 90,000 miles

Starratt Airways and Transportation, Ltd., of Hudson, Ontario, also now part of the C.P.R.'s general transportation system, handled 29,739 lb. of freight during the week from July 12 to July 18, and in the same time carried 109 passengers to and from the mining regions of north-western Ontario and northern Manitoba. In water operations the company moved approximately 247 tons of freight during the same period over the route from Hudson to Gold Mines and Red Lake by boat and scow. Over the route from Hudson via Root Portage to Dog Hold Bay approximately 36 tons of freight were moved.

Ginger Coote Airways, Limited, Vancouver, another link in the company's new air services, is operating five seaplanes, one of which is held in reserve. Traffic handled by this company from January 1st to July 15th continued to increase on schedule routes, in spite of the fact that Government flying for fisheries, forest patrol and aerial photography was largely discontinued due to economy.

Yukon Southern Air Transport, Ltd., of Edmonton, is one of the existing air services recently taken over by the company. Tourist traffic was expected to take up a normal slack in the sub-Arctic air operations which have always existed during July and August, but July passenger traffic was light. (The activities of C.P.R. in Canadian air transport have been given previously in *Flight* for June 19th and 26th and September 18th.)

FLEXILANT PRODUCTS

THE announcement has been made of the formation of Rubber Bonders, Limited. This company has been formed to continue the combined work hitherto carried out by the Dynaflex Division of the Manganese Bronze and Brass Co., Ltd. and the Empire Rubber Company. The former of these two concerns are experts in all kinds of non-ferrous work, alloys, electro plating, and marine engineering and marine propellers. The Empire Rubber Company are specialists in the now very advanced subject of rubber moulding.

The work of the new concern, whose trade mark is "Flexilant," has hitherto been in the hands of the Dynaflex Division, due to their having begun working some years ago under the patents of Messrs. S. A. Paulstra, whose trade mark is "Dynaflex."

IT MAY NEVER HAPPEN

A Few Words About Airframe and Engine Reliability, Parachutes, Rational Structures and the Future

WITH the customary superstition of flying people—or, perhaps, with natural caution and a desire to be *quite* sure—I should make a dive at the nearest piece of timber before writing the fatal words: Aeroplanes are remarkably reliable nowadays. They are. Despite rapid production and all manner of difficulties and troubles which might be expected to produce unreliability, the engines and the airframes continue to function in the most surprising conditions.

Some years ago, when all-metal and stressed skin construction were just coming into fashion, certain high-ups remarked that this sort of thing would be no good for war purposes—that nice pieces of wood and wire, with solid spruce spars, would continue to hang approximately together when the beautiful metal aeroplanes would be falling out of the sky in little bits. That lumps of wood could take any number of bullets, while any serious damage to the skin, or the comparatively light gauge metal used in making up spars and longerons, would cause the whole structure inevitably to collapse.

As is so often the case, the clever people were proved wrong. Not that they weren't quite right in theory. So many other factors entered into the problem, and these factors tended to be forgotten. Furthermore, very few aeroplanes are designed as pure stressed-skin or pure any-other-kind-of construction, and the people responsible have not, in any case, entirely forgotten the possibility that bullets and cannon shells *do* tend to make rather a hash of their otherwise excellent stress calculations.

Flying Cullenders

All of us have read of—and some of us have had ocular evidence of—the sort of things which can happen to aircraft structures, leaving the machine still in a more or less airworthy condition; wings which are more like cullenders and tail units which are that only in name and vague outline. And I think it is fair to say that our own aeroplanes stand up to this sort of thing more satisfactorily than those of the enemy. For an explanation of that we must look into psychology—we are less remorselessly efficient and logical than the Germans. Our aircraft are still the products of slightly muddled thinking and democratic ideals in the design offices. There is, in fact, a certain amount of waste and duplication everywhere in British machines, while the German machines are usually beautiful examples of economy, efficiency and over-rational thinking. Few unnecessary bits are to be found in them, so the wings tend to come off or the engines to fall out when any vital members are seriously damaged.

The majority of people who are at all interested in such things have seen, for instance, Messerschmitt 109s on show here and there. Beautifully simple little things—at least to the comparatively uninitiated. Look at the engine mountings and the structure of the fuselage; not a scrap of unnecessary material. Then go away and have a look at the structure of some of the British machines; it looks rather a muddle, but that turns out to be a distinct advantage when things are happening.

Perhaps even more remarkable in these days is the extraordinary reliability (timber touching, again!) of aero engines. One way and another they have a fairly tough time and are not always as well looked after by ground crews or as well and carefully handled by the pilot as they might be. Things *do* happen inside them from time to time, but it is rarely that they actually stop without lots of warning. And that, of course, is partly where all these "unnecessary" instruments and things come in.

The old-type pilot tends to look at modern instrument boards, sniff, and say that he would be a lot happier without such things as oil inlet and outlet temperature gauges. But when anything is seriously, but not finally, wrong it is these instruments which will give you the real and useful warning ten minutes before the motor starts to break up. Several times I have had pressures going down and temperatures rising and have got safely back on to the ground before anything very terrible has happened—though in two cases the filter was found to be full of "gold dust," and without the warning the engines would undoubtedly have seized up and/or pushed connecting rods through the crankcases. The "unnecessary" little dials, in these cases, saved the Government quite a lot of money.

Keeping On

But even when—on very rare occasions—bits start to break or fall off, the modern engine tries very hard to continue to give some power. Enough to make the aerodrome in the case of single-engined machines, and enough to be used during the final approach, after a flight on one engine, in the case of twins. I remember one case of a pilot who brought a machine back to its home aerodrome with half the crankcase missing from an engine and with the con. rods and other assorted items in full view, yet that engine continued to give some power and the pilot didn't really know how bad the damage was until he had got down and had a look at it.

Then there are the usual cases of strange and inexplicable noises or temporary loss of power; nothing is done since nothing can be found, and it is hours of flying before, on a major overhaul, it is discovered that a valve-spring has gone or there is a loose nut flying around inside the impeller casing. It is seldom that engines actually stop, though they sometimes give the pilot a momentary nerve shock before he settles down to the job of making something of what is left. And it is remarkable what *can* be done with partially crippled aircraft once the first shock is over and it is discovered that the outfit still flies.

Operational pilots know all about that, but even less important pilots and crews know something about it. When lightly loaded, it is quite surprising, for instance, how well a large aeroplane will fly with a great part of the fabric missing from the wing, or even how quite large areas of lifting surface or control surface can depart suddenly with a queer bumping effect while the machine still carries on with one wing or the other rather heavily down. It is queer, too, how large bits from the fuselage or centre section so rarely damage the tail unit as they hurtle away in the slipstream. I once lost quite a heavy panel from the fuselage, yet not a mark could be found anywhere, and if it hadn't been for the shock of its departure and the sudden draught, I should have imagined that it had just been quietly left off by those whose job it was to see that things which ought to be done are not left undone.

The fact is that we no longer expect aeroplanes to fall to pieces or engines to stop—as we did even ten or twelve years ago—but I often wonder what pilots' and passengers' reactions will be, after this war, to the old, old parachute question. Most of us have become so accustomed to wearing these things that we feel strangely naked when we fly without them. Maybe we shall become accustomed to the old ideas; certainly I never think of wearing a parachute when flying any of the light aeroplanes which are now being used for communication work. That is a matter of ingrained habit. Those who have learnt to fly in this war may always demand parachutes, while we pre-war pilots will go happily back to the old ways. "INDICATOR."

RUDDERLESS FOR SAFETY

The Skyfarer Turns on Ailerons and Elevator

GREAT simplicity of control and optimum safety under all conditions of operation are outstanding characteristics of a light private aeroplane of new design which has been recently announced as in production in U.S.A. The basis upon which the design of the new craft was developed and perfected is an aerodynamic principle that affords full control and manœuvrability of an aeroplane though the rudder is completely absent. This principle has been developed by Otto C. Koppen, professor of aeronautical engineering at the Massachusetts Institute of Technology, and the construction embodying it, designed by Prof. Koppen, has been patented.

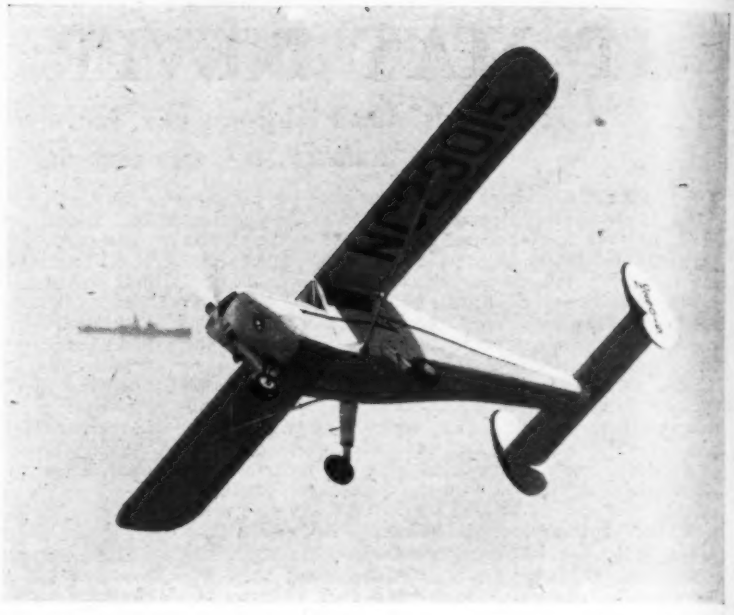
The design and construction of this new craft, named the Skyfarer, have been approved by the Civil Aeronautics Board, which pronounced it "characteristically incapable of spinning," and granted an Approved Type Certificate to the manufacturers, the General Aircraft Corporation, of South Lowell, Massachusetts.

The major objective in designing the craft was to make inherently impossible the various flying accidents which are the result, in the great majority of cases, of pilot mistakes and errors of judgment. Simplification of flight control is the obvious remedy for pilot mistakes, but to be safe the aircraft must have other safety provisions built into it. This has been done in the Skyfarer, which is of a design that makes it automatically stable in flight so that it cannot go into a spin but recovers level flight from the stalled position. It is fitted with a nosewheel undercarriage and with wing flaps. Four years of development work preceded production of the final model.

Landing Speed Range

The results accomplished, according to Charles W. Sutherland, a veteran pilot and president of the company, are that the aeroplane cannot spin, side-slip or skid. nor is control lost in the stalled attitude. It can be taken off or landed in a cross-wind without undue skill, and there is no risk of ground-looping or nosing over. The landing run can be held to less than 200ft., and the craft is completely controllable and steerable after 100ft. of run. Its landing speed can be anything between 45 and 80 m.p.h.

"We are prepared to demonstrate," stated Mr. Sutherland, "that any normal person who can operate an automobile can not only solo the Skyfarer but can also make perfectly banked turns after two hours of dual instruction. After ten hours' flying he will be able to accomplish precision spot landings and will require only further experience in judgment of distance, weather and air speed to be a finished pilot."



The Skyfarer is an American design intended for private owners It has only two controls, the necessity for a rudder having been eliminated. Safety should be its long suit.

Controls

Flight control of the craft is as simple as bicycle riding or car driving, and can be learned as quickly, for with the rudder and its controls eliminated, the student pilot need not acquire that most difficult accomplishment—the co-ordination of simultaneous hand and foot action to adjust ailerons and rudder to the precise relative positions for making turns without skidding toward the outside of the turn or slipping inwards.

Instead of three movable flight controls that must be co-ordinated by hand and feet, the pilot has only two—elevator and ailerons—both operated by the hand wheel. This is, as customary, pushed forward to descend and pulled back to climb, and is turned to control direction in the horizontal plane as in a motor car. Thus all actions are instinctive and nothing has to be unlearned. For instance, there can be no "crossing" of controls, as sometimes may occur in a conventional three-control aeroplane when a pilot makes a banked turn near the ground just after take-off. Appearances due to drift caused by a cross-wind may confuse him into thinking he is slipping inwards and so cause him to apply bottom rudder to overcome the imaginary slip. This may produce a dangerous skid towards the upper wing.

Another dangerous mistake that cannot be made with the two-control craft is that of applying rudder on the high side in an attempt to maintain altitude in a bank that is too steep for the power and speed of the aeroplane. This application is made at a time when the plane is losing speed and may easily start a spin in a direction around the high wing.

Assurance against such natural errors of judgment gives the pilot the confidence that is so essential to rapid learning and enables him to make turns with greater precision and at lower altitudes than would be safe with a three-control machine.

Landing Gear

Tricycle landing gears which have been developed in the last five years and are now being applied to some of the largest bombers and transports, are a return to a type used on the earliest flying machines. Besides the obvious advantage of preventing nosing over and ground-looping in event of bad landings, bouncing and skipping do not occur after ground contact because the pair of rear wheels are aft of the centre of gravity. Consequently the tendency is for the tail to rise, decreasing the angle of incidence of the wing, thereby reducing the lift and keeping the wheels on the ground. Application of the wheel brakes immediately after ground contact, or even before, produces no serious results. The nose wheel is steered by the pilot's

hand wheel and, therefore, only one pedal is required for the brakes on the main wheels.

Landings with the Skyfarer are made with more precision and with enhanced safety by the use of flaps which can be adjusted by a hand lever to either of two operating positions. Part-down position is used for making a normal landing approach. In full-down position the flaps reduce the stalling speed from 50 m.p.h. to 44 m.p.h., and give the flattest glide path at the lowest speed at which flight can be maintained. The flaps can be applied suddenly if the glide angle seems too flat, or may be raised as easily and safely to reduce the angle and avoid under-shooting the landing spot. The glide path can be controlled, also, by the instinctive actions of raising the nose to prolong the glide and depressing it for a quicker descent so as not to overshoot.

RUDDERLESS FOR SAFETY

As the photograph shows, the Skyfarer is a high-wing monoplane having a double-fin tail. The fuselage is built up of aluminium-alloy angles and channels assembled with cadmium-plated nickel-steel bolts instead of welding. The cabin seats two persons side by side and affords excellent visibility over the low, flat nose and to both sides. An aluminium-alloy D-section, stressed-skin spar and ribs of the same material, riveted together, compose the wing, which is fabric covered to the rear of the spar. Fabric also covers the fuselage, ailerons and tail surfaces. Power is furnished by a Lycoming four-cylinder 75 h.p. geared engine with rubber mountings.

To simplify inspection and repairs, easy accessibility is afforded to all portions of the aeroplane that should be examined frequently, and use of heat-treated parts and welded structures is avoided as much as possible.

Principal specification figures of the craft are as follows:—

Length, 22ft.; wing span, 31ft. 5in.; height to top of fin, 8ft. 8in.; wheel track, 5ft. 4in. Total loaded weight, 1,350 lb.; empty weight, 890 lb.; disposable load, 460 lb.; tankage, 20 U.S. gal.; baggage 40 lb. Wing loading, 11.1 lb./sq. ft.; power loading, 18.0 lb. per h.p.; rate of climb, 550ft. per min.; top speed, 100 m.p.h.; stalling speed (flaps up), 50 m.p.h.; stalling speed (flaps down), 44 m.p.h.; landing speed, 45 to 80 m.p.h.

GUYNEMER ANNIVERSARY

Flag Presented to Free French Air Force by Chief of Staff

THE anniversary of the death in action of Captain Guynemer, France's airman hero of the last war, was commemorated on September 11th at all R.A.F. stations in which Free French airmen are stationed, and at one of these stations the flag of the Free French Air Force was presented to the troops

Admiral Muselier held an inspection of officers and men of the Free French Air Force and Free French Fleet Air Arm, a detachment of the Feminine Air Auxiliary Section and the band of the Free French Army. The Admiral was accompanied by Lt. Col. Pijeaud, Chief of Staff of the Free French Air Force, and Lt. Col. Renouard, commanding the camp.

Lt. Col. Pijeaud, presenting the flag, said:

"Officers, N.C.O.s, corporals and men of the Free French Air Force, I present to you the flag of the Free French Air Force. A flag is the symbol of the Mother Country, blue, white and red, our French colours, the three colours that your elders, your fathers, your ancestors have gloriously carried through the entire world. It is for the flag that one fights, it is to the flag that everyone rallies. It is the flag that one must prevent from falling into enemy hands at any cost."

Adding that the flag was the "symbol of our determination to throw the enemy out of France," Lt. Col. Pijeaud told them that this one should lead the flags of all the squadrons on the day of their victory parade.

Lt. Col Pijeaud presenting the flag.

Posthumous Mention

After this speech the traditional reading of Captain Guynemer's posthumous mention in dispatches was made:

"Capitaine Guynemer. Mort au Champ d'Honneur, à Poelcapelle, le 11 Septembre, 1917. Héros légendaire, tombé en plein ciel de gloire, après trois ans de lutte ardente. Restera le plus pur symbole des qualitiés de la race: tenacité, indomitable, énergie farouche, courage sublime. Animé de la foi la plus inébranlable dans la victoire; il légue au soldat Français un souvenir impérissable qui exaltera l'esprit de sacrifice et provoquera les plus nobles émulations"

Afterwards, the troops saluted past the flag, Admiral Muselier, the Senior Free French Air Force staff officers and the officers and men who recently escaped from the Continent.

The airmen, dressed in the French Air Force blue, and white gloved, marched to the band of the Free French Army. The women of the Feminine Air Section were specially noticeable for their smartness and their military bearing.

WHY HURRY?

A Fresh Approach to an Old Subject

By "KISMET"

IF commercial flying is to restart after the present surfeit of military aviation has ceased, and also if the air transport companies have got to "fly by themselves," as they must do ultimately, the writer is of the opinion that an entirely new approach must be made to the question of attracting the general public.

It will not pay, and never has paid, to cater for a small minority in any form of public transport undertaking. There must be an attractive alternative available to the offer of sheer speed. To make the underlying principle clear, a couple of examples will be cited that convey impressions of different types of traveller, both being prepared to pay for their particular wants, but neither being interested in the requirements of the other.

Railway Records

The Cheltenham Flyer, while not an aeroplane, happens to be the crack express of the G.W.R. It is *some* express, as our American friends would say, and relies on the fastest non-stop run of any regular passenger-carrying train in the world to attract custom. The average speed between terminal points is over 71 m.p.h. Many folk make a point of having a trip on it just to be able to say that they have done so. Very well. No doubt the directors of the railway find it worth while in the broad sense; but, owing to the high fuel consumption (using coal of the very best quality), having to subordinate every other schedule on that section of the line to give the Flyer a clear run, the upkeep of the whole train on which wear and tear must be higher than average, and so forth, it is a matter of doubt as to whether the revenue derived from the fares of passengers ever shows a profit. To get their profit the company runs all sorts of other and slower trains. Some are still expresses, some not so fast as that, and yet others purely local, which stop at every station. If it were possible to make money out of nothing but crack expresses the company would surely do so; they would only need a dozen stations instead of hundreds, a fraction of the staff, and far lower overhead expenses. But no! A fleet of Cheltenham Flyers would not be a commercial proposition on account of the exorbitant cost of . . . *speed*.

THIS article, written before Mr. John Morrison's suggestion for an Empire Air Express was published in our issue of September 4th, 1941, is the very antithesis of the arguments there put forward. The one pleads for the greatest possible speed, the other for the lowest.

It is well that both sides should be kept in mind, and there is no doubt that in the post-war years there will be room for both, but the sort of service outlined here will probably form but a small percentage of civil flying.

Second Example

Most of us have been to the seaside, and at the larger resorts we may have noticed the motor boat proprietors shouting out the details of the next trip round the pier or lightship. The boats provided are large and roomy, and nobody is ever in a hurry to start. After paying the fare you climb in sit down, and await events. Gradually the boat fills up and, when the maximum number are on board, off she chugs. The whole aim is to provide half a day's fun for a very moderate fee, and to give as *long* a trip as possible. People pay for enjoyment, fun, the sea and air, anything you like to call it except . . *speed*. Should they desire a really fast trip they find a man who is out to sell speed as such, and nothing else. He probably has a Cris-Craft, and they pay him, not for a jolly and leisurely cruise, but for the thrill of scudding along with the bows out of the water and the sting of salt spray lashing their faces. There is always a scramble to bag a front seat in these boats, and there is generally a streamlined young blonde with her hair flying out backwards who gets the position of honour. (One pipped me on the post last time!) The trips in these speed boats last only a few minutes, and once again the terrific fuel consumption is the main cause.

Having got as far as this, I think that we can conclude that both the railways and the motor boat people cater for at least two different classes. So, of course, do the road transport folk, with the common or ordinary bus, the limited stop coach, and the express coach. Plenty of room for each type, as well. So let us see if these facts can be usefully applied to the field of commercial aviation.

Getting Into a Rut

A consideration of things as they were, *circa* 1939, leaves the impression that to capture the air passenger traffic it was essential above all else to offer a saving of time. WHY?

Doubtless the Captains of Industry and the Sultans of Sweat must rush about over the face of the globe from time to time, but is that a valid reason why everyone else should have to rush, too?

Of course not!

It is utterly ridiculous that just because Herr Hoggstrasse wanted to see Mr. Ramsbotton hurriedly, he was able to dictate to Europe that the network of airlines had got to operate faster and faster each year. By all means have some very fast inter-capital air expresses, but why not give the general flying public a chance to spend longer in the air for the same cost? In other words, sell FLYING as well as speed.

Again, there was a long-distance complex setting in just before the war. I remember asking at Croydon some questions about a plane to Berlin, and the receptionist at the counter actually apologised because my plane would stop at Rotterdam, thereby being 15 minutes longer than those that flew direct. Honestly, now, what on earth does a quarter of an hour matter to me or anybody else on a run of 600-odd miles?

Getting Out of the Rut

Suppose that a company started up after this war is won, and used machines that, while being slow and sure, were cheap to operate, easy to maintain, simple to service, and which did not cost too much to buy. Could that company make a paying proposition of selling flying for its own sake? To keep expenses down to a minimum I would suggest the following two routes as ideal specimens of busy short-stage trips.

Route A.—Ramsgate - Canterbury - Lympne - Shoreham-Portsmouth-Ryde-Bournemouth.

Route B.—Ramsgate-Canterbury-Rochester-West Malling-Gatwick-Brooklands-Bournemouth.

The round trip, out one way and back the other, could be done with ease inside a day, even with a schedule speed of 60 to 70 m.p.h. ground to ground. If D.H.86As were used the all-in operating cost should not be more than 1½d. per passenger mile. Fares at 2½d. per mile per passenger would give these figures, to the nearest 3d. per stage single.

RAMSGATE.						**ROUTE A.**
2/9	CANTERBURY.					
5/9	2/9	LYMPNE.				
18/3	15/3	12/6	SHOREHAM.			
26/3	23/3	20/6	8/-	PORTSMOUTH.		
28/-	25/3	22/3	10/-	1/9	RYDE.	
34/3	31/6	28/6	16/-	8/0	6/3	BOURNEMOUTH.
RAMSGATE.						**ROUTE B.**
2/9	CANTERBURY.					
8/6	5/9	ROCHESTER.				
10/3	7/6	1/9	WEST MALLING.			
15/6	12/9	7/-	5/3	GATWICK.		
19/9	17/-	11/3	9/6	4/3	BROOKLANDS.	
34/3	31/6	25/9	24/-	18/9	14/6	BOURNEMOUTH.

WHY HURRY ?

The figure that I have taken as the basis of operational cost is derived from "The Economics of Air Transport," by Noel-Brown, plus an increase for post-war conditions. The fares compare not unfavourably with those charged by the Coastal Express Motor Coach Service from Margate to Bournemouth, and are, on the whole, cheaper than the third-class railway fares over either route.

Traffic

During the summer season, from Whitsun to mid-September, tens of thousands of holiday-makers would spend from a few shillings to a few pounds on the pleasures of travel inside the area under review. Motor coach mystery tours were run from all the principal towns; excursions to every well-known beauty spot south of the Thames were a daily feature of both rail and road companies; numerous pleasure steamers made voyages along that stretch of coast, round the Isle of Wight, and across to the Continent. All were well patronised. All made a profit.

There must have been hundreds of motor coaches alone, carrying thousands of people, seven days a week, to and fro, up and down, across and across, Kent, Surrey, Sussex and Hampshire. These people were NOT in a tearing hurry, but were out to admire the views, enjoy the air, and see new places. Also, they were quite prepared to pay for it.

Conclusions

I contend that there will be, after the war, a vast reservoir of people ready to be catered for by all forms of transport companies. Over the twin air routes mentioned in this article (both internal ones), I fail to see why two dozen aircraft could not operate daily in the season, maintaining an hourly service from 8 a.m. until dusk. A service every two hours would probably pay quite well in the spring and autumn.

The airports mentioned, with not more than two exceptions, always provided good food at moderate charges. Some, such as Shoreham, were outstanding from this point of view. Others, like Brooklands, offered an objective that was unique.

Let the people fly—cheaply and slowly.

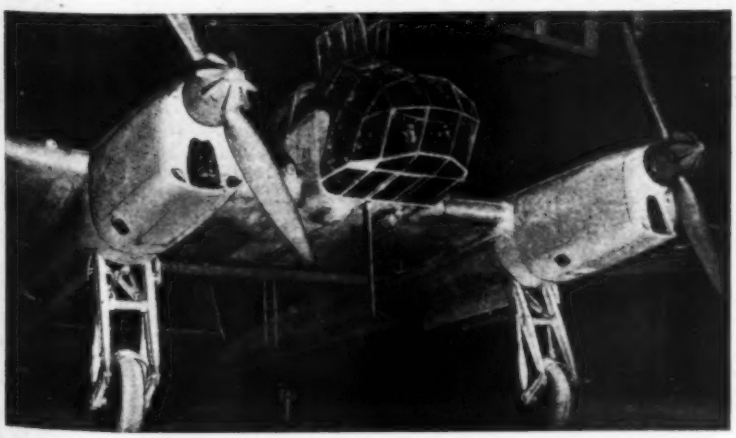
Once started it will become a habit, and the habit will spread until it becomes a custom. But if nothing better than 250 m.p.h. blind dashes to devastated corners of Europe can be had, and then only for £20 or £30 a time, I cannot see any future for commercial aviation at all. It will degenerate into the highly subsidised prerogative of ambassadors.

"THE EYE IN THE SKY"

An Unorthodox German Reconnaissance Monoplane

THESE photographs show an enemy machine with which people in this country are not yet familiar. It is the German Focke-Wulf FW 189, a reconnaissance type, referred to by them as "das fliegende Auge" (the flying eye), which we might translate better as "the eye in the sky." Designed for reconnaissance or ground attack, the FW 189 has wonderful views forward, upward and downward.

The sideways view is somewhat spoilt by the engines these having been reported as two Mercedes-Benz DB 601 or Junkers Jumo 211 twelve-cylinder inverted vee types. But in these photographs they look rather smaller and are air-cooled, and the fact that the airscrew is only two-bladed lends support to the assumption that the engines are of small power. These particular ones may be Argus As 410 twelve-cylinder air-cooled of 450 h.p. take-off rating. If so, the resulting low speed would seem to indicate that the machine is entirely for reconnaissance. The purpose of the vanes on the airscrew spinner has not yet been ascertained definitely, but they may be concerned with pitch-changing. The normal crew is three, there being two rear gun positions. For ground attack the FW 189 is probably fitted with two fixed guns in the wing firing forward alongside the crew nacelle. The undercarriage is of unusual design, the main members being of H-section instead of the orthodox tubing. They are probably aluminium alloy castings, though it is just possible they are magnesium alloy, but this is not likely



(Top) This rear view of the FW 189 makes it very evident why it is described as a "Doppelrumpfflugzeug."

(Left) "The eye in the sky" provides the pilot with excellent view for his reconnaissance duties. Undercarriage design is unorthodox, having H-section members instead of tubes

The FW 189 is a design of Diploma-Ingenieur Kurt Tank, the technical head of the Focke-Wulf aircraft works. It should not be confused with the FW 198, which is a single-seater fighter monoplane also with twin tail booms. This machine has a single engine with pusher airscrew located behind the pilot.

On page 223 another view of the FW 189 is shown. This clearly shows the two gun positions.

HERE AND THERE

SIDE VIEW OF THE FOCKE WULF 189: This reconnaissance machine has two rear gun positions, but visibility from the aft one may be considerably distorted by the great obliquity of the transparent panels. A description of the FW 189 is given on page 221.

R.A.F. in Florida

R.A.F. trainees, to the number of 550, have arrived in the south-eastern States of U.S.A. to undergo training there before returning to Britain. One of the stations they have been sent to is Florida. After ten weeks on primary training and twenty on advanced flying, they will return to Britain to go through Operational Training Units.

Aerodrome Turntables

WHEN manœuvring twin-engined transports on the tarmac by means of braking one wheel and revving up the opposite engine it is possible to impose severe strain and wear on the tyre of the braked wheel. At the new Washington airport in U.S.A., says the *Civil Aeronautics Journal*, twelve turntables have been installed at the loading ramp to aid manœuvring and to reduce this wear.

Each turntable is a 6ft. circular steel disc, cupped at the centre to facilitate the positioning of the pivot wheel of the aircraft. The disc is supported at its circumference by sixteen rollers which run on a circular track below.

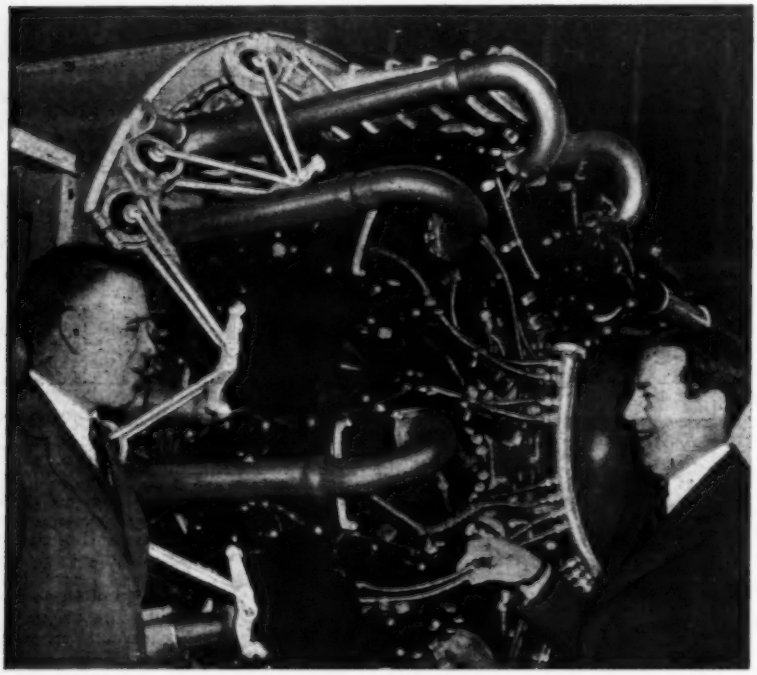
Inclined Compass

THE Kollsman Division of the Square D Company has developed a compass with its face inclined at 45 degrees. Previously all compasses have had either horizontal or vertical dials. The new development has been necessitated by the mounting of the compass lower down on the instrument panel.

M.A.P. Appointments

COLONEL MOORE-BRABAZON, the Minister of Aircraft Production, has appointed Mr. Alexander Dunbar to be Deputy Controller General and Mr. F. Forbes to be vice-chairman of the Production Committee of the Ministry.

Sir Charles Craven is the Controller General and Chairman of the Production Committee. Mr. Dunbar was the Director General of Material Production at the Ministry and will continue to carry out these duties in his new post. Mr. Forbes will continue in his appointment as deputy secretary.



THE WRIGHT DUPLEX CYCLONE: Robert W. Patterson, Assistant Secretary of War in U.S.A., and Donald W. Douglas inspect the 18-cylindered Duplex Cyclone in the giant four-engined Douglas B-19 bomber which flew recently. The new-type "dynamic mounting" holds the engine by the cylinder heads of the back row by means of short links with the rear ends attached to the structure by rubber mountings which allow slight movement vertically, horizontally and tangentially. (See *Flight*, March 28th, 1940, page 286c, for full description.) The arrangement of the exhaust system is also most unusual.

New N.A.C.A. Chairman

FOLLOWING the resignation of Dr. Vannevar Bush, the National Advisory Committee for Aeronautics in U.S.A. has appointed Dr. Jerome C. Hunsaker to be chairman. Dr. Hunsaker has been associated with the scientific and technical side of aviation since he was instructor in aeronautical engineering at the Massachusetts Institute of Technology in 1912.

Since then he has been a designer for the U.S. Navy, vice-president of the Goodyear Zeppelin Corporation, and is now head of the mechanical engineering department at M.I.T. *Flight* sends Dr. Hunsaker good wishes for the important work on which he is now engaged.

Australian Plywood Specification

THE Standards Association of Australia has issued a specification for aircraft plywood. For about five years past aircraft plywood has been manufactured, the first timber used for the purpose being the native species of coachwood, but it is likely now that other kinds have been found suitable. The specification deals with general provisions for all plywood, minimum requirements for structurally unimportant parts and for structurally important parts of the aircraft. Appendices give figures on thicknesses and tolerances, moisture content, resistance to water, bending properties and tensile strength.

B.O.A.C. Finances

A REPORT in the *Financial Times* for September 10th states that a Treasury return shows that £3,000,000 of the capital of British Overseas Airways Corporation is held by the Post Office Savings Bank and the remainder of £1,250,000 by the Trustee Savings Bank. In addition, up to £2,250,000 can be borrowed by the Corporation.

This statement recalls the article, "Exit Civil Aviation?" published in *Flight* for March 21st and April 4th, 1940. Our contributor, "McAnguish," then expressed some concern as to who was to be allowed to hold the capital of this Government-guaranteed monopoly, and when the Hon. Clive Pearson, the

chairman, explained the merger of British Airways and Imperial Airways to form the Corporation, he made no statement on this question except to say that the stock would be disposed of privately.

We believe that "McAnguish" will be satisfied by the finding of the capital from the small deposits in the savings banks, as this seems to be the right thing to do with the capital of a nationally owned airline. To have allowed the stock to be bought up by powerful private financial companies would, in our opinion, have been most undesirable, as this might have caused some private control of an organisation which belongs essentially to the people.

Chevrolet to Build Pratt and Whitneys

THE Chevrolet Division of General Motors will build Pratt and Whitney aero engines. Funds totalling over £9,000,000 have been made available, over £8,000,000 of this being for machinery and equipment.

Business Appointments

AT a recent Board Meeting of Kayser, Ellison and Co., Ltd., the following appointments were made: Captain Leonard A. K. Halcomb to be Deputy Chairman; Mr. Percy B. Henshaw and Capt. L. A. K. Halcomb to be Joint Managing Directors, along with the Chairman, Mr. Charles Wm. Kayser, J.P.

Atlantic Ferry News

NEWS from the American end of the Atlantic Ferry, given in *Aviation* for August, confirms that the U.S. Army has now assumed formal command of the delivery of military aircraft from U.S. factories to the Atlantic coast. The U.S. Ferry Command is under the charge of Col. Robert Olds, of the Army Air Force. Civilian pilots are being used in this Command until sufficient Army pilots can be assigned to duty. The U.S. Ferry Command also operates a service from Bolling Field, Washington, to England for the quick transit of high officials and documents, probably in Boeing Fortresses.

Services across the Atlantic are shrouded in a certain amount of secrecy but it seems likely that they operate in this way: The R.A.F. Ferry Command, under Air Chief Marshal Sir Frederick Bowhill, from Baltimore and Montreal to Britain (bomber delivery); Pan American to Lisbon (passengers); and also via Brazil to West Africa (bomber delivery); U.S. Army Ferry Command, Washington to England (diplomatic). It is possible that another service may be started from U.S.A. to Iceland by the U.S. Navy.

SOFT-VOICED VENTURA: The new Vega Ventura, which resembles an out-size Hudson, is now being built for the R.A.F. at Burbank, California. Here is one just before its maiden flight, and report says that the new paddle-blade airscrews (note their blunt tips) render this aircraft comparatively silent.

B.O.A.C. Press Officer

MR. FRANK HILLIER has been appointed Press Officer to the British Overseas Airways Corporation.

Mr. Hillier entered the Government's service from Fleet Street in February, 1939, when he was appointed Press Officer to the Ministry of Civil Defence. In May, 1940, he became Press and Publicity Officer to the Ministry of Home Security

LATEST "FORTRESS": Here is one of the newest versions of the Boeing "Flying Fortress," the B-17E, on a test flight over Seattle. Better armed than its predecessor, it has a gun turret on top of the fuselage as well as beneath and in the tail A large number of B-17Es are on order for the U.S. Army Air Corps.

Pilot Rating by Power

THE Civil Air Regulations of U.S.A. now provide that pilots' certificates are classified by type, class and horsepower of the aircraft instead of type and weight. When considered competent on an aeroplane of one power the pilot is given permission to fly aircraft in the power range of 50 per cent. less to 50 per cent. greater, except below 80 h.p., when he is licensed for the whole range of 80 h.p. If a pilot is competent in two power ranges he is automatically licensed for all intermediate powers.

Types of aircraft are divided into five —single and multi-engined landplanes, single and multi-engined seaplanes and flying boats, and unorthodox types.

Flying on Producer Gas

A REPORT in *Foreign Commerce Weekly*, issued by the U.S. Department of Commerce, states that an Italian aeroplane has flown on fuel generated from charcoal, presumably producer gas. The aircraft, a Breda 15, made a successful test flight of 15 minutes at an altitude of 500 feet. The gas generator weighs 176 lb., and 90 lb. of charcoal is said to be necessary for a flight of two hours. The engine is 85 h.p.

This achievement is of interest, but there appears to be little possibility of great developments ahead of it. One cannot imagine any military aircraft using such a source of power, and there seems little to recommend the system even for private-owner machines

Parent Company to Continue Business

A CHANGE of name, to Field Consolidated Aircraft Services, Ltd., has recently been registered by Rollason Aircraft Services, Ltd. "Field Consolidated" will conduct the business operations of Rollason Aircraft Services, Ltd., and its subsidiary companies, Rollason Aircraft Instruments and Equipment, Ltd., and Tollerton Aircraft Services, Ltd.

The name of Rollason Aircraft Instruments and Equipment, Ltd., has also been changed and will henceforth be Field Aircraft Instruments and Equipment, Ltd.

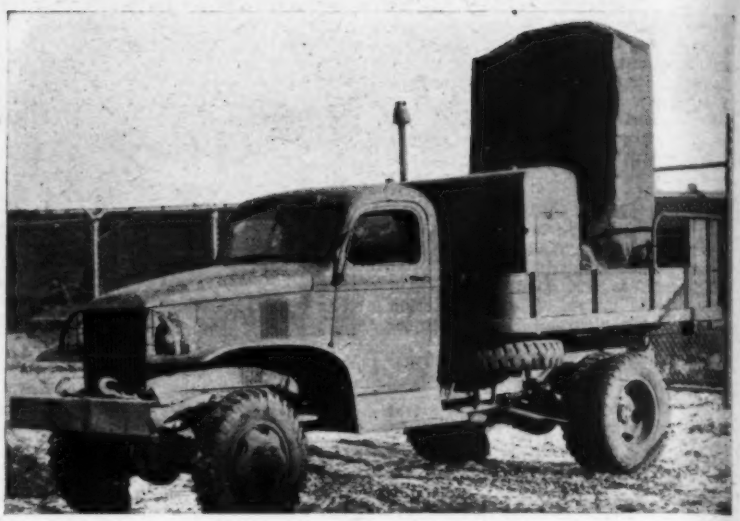
In a young industry Rollason Aircraft Services was one of the oldest companies operating extensively in this important field.

PORTABLE AERODROME LIGHTING

Boundary and Floodlighting for Emergency Fields

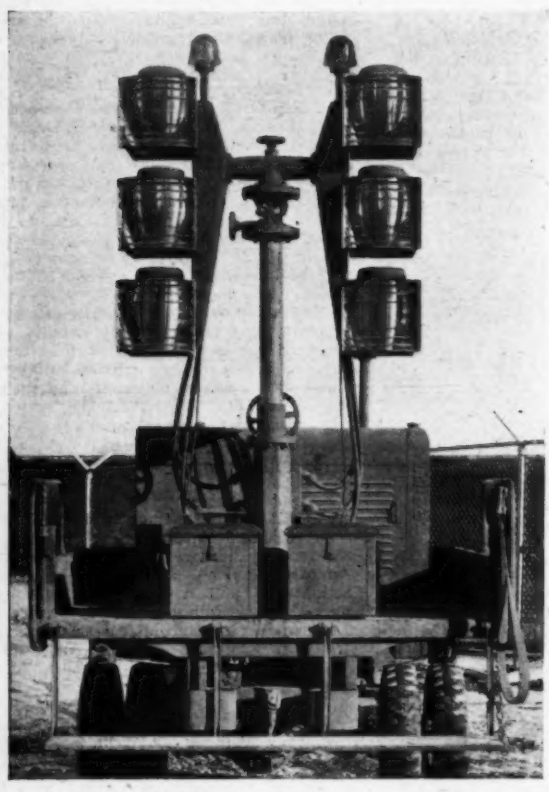
COMPLETE sets of aerodrome boundary lights that can be moved by air transport, and self-contained floodlight units mounted on motor trucks built for rough cross-country travel, have been developed by the Materiel Division of the U.S. Army Air Corps at Wright Field, Ohio. This equipment is designed for temporary and semi-permanent lighting of new landing fields acquired by the Air Corps in its programme of expanding facilities for national defence. Two of the portable lighting sets are being supplied to each aircraft squadron for illuminating normally unlighted fields for night take-offs and landings without revealing location of the fields to possible enemy aircraft.

Packed in lightweight trunks for air transport, a complete set of boundary lights weighs 1,800 lb. Cable for connecting the lamps is carried on a reel provided with wheels for quick and easy reeling and unreeling. Current is supplied by a lightweight power plant that delivers 300 watts at 110 volts. The set includes two green lights for the approach end of a field, white lights for both sides and amber lights for the far end, all mounted on cones about 18in. high, and red obstacle-lights mounted on specially designed telescopic masts having a maximum height of 41ft. Connecting cable is merely laid on the ground in temporary installations, but for extended use is buried to afford protection from wheels and weather.



A sturdy four-wheel drive cross-country truck carries the floodlight and its complete power plant.

The lamps can be arranged to outline a 400 by 5,200ft. landing strip or a general area, or as a string of lights up to 10,000ft. long. To conceal location of the field from enemy observation from above, specially designed hoods are provided which restrict vertical light distribution to angles used in making landing approaches, and the power plant voltage can be reduced to one-tenth the normal output, sufficient for making night landings.



Each floodlighting unit has six lamps with Fresnel lenses mounted on a telescopic pedestal. The mounting can be turned or inclined as desired.

Self-Contained and Adjustable

The mobile floodlight units are transported on four-wheel-drive 1½-ton trucks fitted with special bodies for mounting both power plant and floodlight. The power plant consists of a petrol engine, 32-volt 9 kW. generator, fuel tank, electric starter and battery, all contained in a weatherproof, ventilated steel case. The light unit has six lamps supported on a telescopic pedestal mounted on the truck platform at the rear of the power plant. The lamps are of 32-volt, 1,500-watt capacity and are contained in Fresnel lens housings ground and polished to illuminate a sector of 90 deg. suitable for night landings. The telescopic pedestal and universally adjustable lamp mounting enable the lamps to be elevated and inclined as desired.

The rugged trucks, specially designed for pulling through mud and climbing steep banks, are assigned to certain stations as regular equipment. When permanent lighting is installed at these new fields they will then be transferred to emergency landing fields.

For Dropping Petrol

AN unburstable container for dropping petrol supplies from low-flying aircraft is described in *Indian Aviation*. Developed by the Directorate of Scientific and Industrial Research in India, the container is made of canvas and plastic materials, and tanks in the two-gallon size are reported to have withstood the impact of drops from heights of 75 and 100ft. The Army is making further experiments. It is claimed for the tank that it is lighter and less liable to damage than the ordinary steel container.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters

AFTER THE WAR

Critic's Views Were Not Official

YOUR introductory note to my article under the above heading in your issue of September 18th suggests that it represents the considered opinions of the Air Council. I am not even serving in the Air Ministry, and have no means of knowing what the considered opinion of the Air Council may be.

In any event, the views expressed in my article were entirely my own, and the Air Council have no responsibility for them.

"AIR VICE-MARSHAL."

GERMAN AIR STRENGTH

Do Replacements Exceed Losses?

GERMANY is producing aircraft faster than she is losing them, and Axis air crews are still being trained, says a correspondent writing over the nom-de-plume "Planes," and that unless we bomb heavily the Axis aircraft factories in Austria, Czecho-Slovakia, and S.E. Germany it seems doubtful if their numerical superiority will ever be overhauled even with America's help.

"The possibility of killing Austrian, Czech, and other workers forced to feed the Nazi Moloch," he adds, "can, I am sure, be effectively dealt with by Col. Britton in his messages to the 'V' army." H. B.

AIRSCREW BLADE MATERIALS

Wood Always Lighter for Comparable Designs

MR. GILLMORE puts the case for the dural airscrew blade very ably indeed in your issue of September 18th. However, if he were as closely in touch with wooden blade development as he is with dural, he would perhaps not be quite so sweeping in condemning the former. The fact that by drastic thinning the metal blade now approaches the weight of some wooden designs must not be taken to mean that no further thinning of this type is possible. Actually, the stress margin on most wood blades is large. Wood blades will always be lighter for comparable designs, and they may not even need larger hubs, as he suggests. Much is being done to save veneers used per blade, and the importation of cut veneers does not exhaust the possibilities of saving shipping space.

Finally, they are favoured by pilots for their smooth running.

J. LOCKWOOD TAYLOR.

Metal versus Wood

MR. GILLMORE, in his interesting article in *Flight* of September 18th, on materials for airscrew blade production, might have further disparaged compressed wood had he refererd to the subject of balance.

Generally speaking, compressed wood has been insufficiently homogeneous to permit the balancing of all blades of a series to one mass moment. As a result of this shortcoming the practice was adopted of balancing blades in sets, in consequence of which interchangeability was largely sacrificed on compressed wood blades—rather a serious matter in these days when speed of replacement assumes almost the importance of speed of production itself.

Without in any way wishing to appear as one seeking advertisement for the wares of his concern, I think, nevertheless, it is of interest to note that the new "Hydulignum" blades (an all-English invention which Mr. Gillmore overlooked), now in production, are definitely balanced to ONE master and are therefore 100 per cent. interchangeable.

It is a noteworthy fact that Hydulignum material should have been overlooked in Mr. Gillmore's article, since so many of the shortcomings contributed to compressed wood which he mentioned become more than highly debatable in the particular case of this material. No doubt others will have something to say about the merits of wooden blades, with the progress of which Mr. Gillmore could not be expected to be familiar, and we hope that our design department will find an opportunity, when they have time, to make their contribution to this debate. A. A. D. LANG.

TO HASTEN PRODUCTION

"Capacity Exchanges" for Manufacturers

ALTHOUGH some of your readers may already have been in contact with the Machine Tool Capacity Clearing Centres of the Production Executive Regional Boards, there may be others who have not learned of the help these clearing centres can be to works managers, production managers and other executives when up against the problem of finding spare capacity or of finding work for temporarily idle machines.

In the London and South-Eastern Region (London, Kent, Sussex and Surrey) we have ten clearing centres. They are in effect capacity exchanges, designed to do for manufacturing capacity what the employment exchanges do for labour. Each is in the charge of a technical officer of the Board.

The clearing centres have a comprehensive register of the firms in their district and of their machine-tool facilities. They keep in touch with firms who have spare capacity for which they want work, even where the spare capacity may be available for short periods only. "Spare capacity" fluctuates from day to day, but the aim is to waste none of it that can be used to the national advantage. All this information is kept at the clearing centres in a simple but systematic way so that when a firm asks for assistance it can be put into touch with what it wants with a minimum of formality and delay. Needless to say, the business of fixing prices, deliveries, etc., is left to the two parties who have been introduced.

Altogether the clearing centres of the London and South-Eastern Regional Board effected over 2,000 successful introductions between January and July. In about three quarters of these the value of the job was given and they totalled more than £1,000,000. But I must stress that this is entirely out of ratio with the unassessed value; a million doesn't sound a lot when the nation is spending many times that amount every day. The only true monetary value that could be put on these introductions is the total value of the contracts that would have been held up without them.

The clearing centres aim at fostering a friendly spirit amongst the firms in their districts. The technical officer in charge of the clearing centre gets on close relations with the factory managers in his district, and the danger of factory managers feeling they are going to run into a fog-bound maze of red tape-bestrewn blind alleys is eliminated. There is then a much better chance of factory managers getting together amongst themselves and seriously co-operating with each other—which is just the object of the whole clearing centre scheme. And there is far less chance of any capacity being overlooked.

May I urge all concerned to get into touch with their local clearing centre at once? There is nothing to be lost, since the service is free. Like all exchanges, the more people use them the more efficiently they run. The greater the number of new users the better service everyone gets, with a widening of the scope of possible benefit to all.

The addresses of the clearing centres in the London Region are as follows:—

ACTON: 60a, High Street, Acton, W.3 (Tel. Acorn 5071). CROYDON: Equitable House, George Street, Croydon (Tel. Croydon 5189). EDMONTON: 198, Fore Street, Edmonton (Tel. Tottenham 5481). ELTHAM: 20, Court Road, Eltham, S.E.9 (Tel. Eltham 5588). HARROW: 15, College Road, Harrow (Tel. Harrow 2602). ILFORD: Rooms 15 and 23, Cranbrook House, Cranbrook Road, Ilford, Essex (Tel. Ilford 0038). WESTMINSTER: Room 429, 4th Floor, Romney House, Marsham Street, S.W.1 (Tel. Franklin 2211; Ext. 2680 and 2673). GUILDFORD: 32, High Street, Guildford. ROCHESTER: Moat House, The Esplanade, Rochester (Tel. Strood 7276). SUSSEX: About to be opened.

The scheme is rapidly being extended to other regions and provincial enquirers can get details from their respective Regional Boards.

SIMON MARKS,
(Deputy Chairman, London and South-Eastern Regional Board.)

[NOTE.—We understand that clearing centres are now being set up in other parts of the country and that details will be available shortly.—ED.]

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

C.T.C. Commandant Appointed

The Secretary of State for Air has appointed Mr. Donald Gill as Commandant of the Civilian Technical Corps, which is an organised body of civilian craftsmen in certain skilled trades from the United States of America who have volunteered for service in the United Kingdom or overseas for the maintenance and repair of naval, military and air force equipment.

Service Postal Regulations

IN order to comply with the special postal regulations issued by the Postmaster-General and to facilitate the return to the sender of a letter or other postal packet, which, for any reason, cannot be delivered to the addressee, all ranks of the Royal Air Force, of the Dominions Air Forces, of the Women's Auxiliary Air Force, and of the Civilian Technical Corps, wherever they are serving, are to ensure that any letter or postal packet, addressed to a destination outside the country in which they are serving, bears on the back of the cover the number, rank and name of the sender, followed by the relevant abbreviation of the force with which they are serving, namely, "R.A.F.," "R.C.A.F.," "R.A.A.F.," "W.A.A.F.," or "C.T.C.," etc.

Awards

THE KING has been graciously pleased to approve the following appointments and awards in recognition of gallantry and devotion to duty in the execution of air operations:—

DISTINGUISHED SERVICE ORDER

Act. Wing Cdr. N. W. TIMMERMAN, D.F.C., R.A.F.O., No. 83.

Act. Sqn. Ldr. J. H. MARKS, D.F.C., No. 58.
Act. Flt. Lt. G. D. LYSTER, D.F.C., No. 83.
F/O. T. F. GILL, No. 75 (N.Z.).

BAR TO THE DISTINGUISHED FLYING CROSS.

Act. Sqn. Ldr. J. D. D. COLLIER, D.F.C., R.A.F.O., No. 44.

Act. Sqn. Ldr. G. P. GIBSON, D.F.C., R.A.F.O., No. 29 Squadron.—This officer continues to show the utmost courage and devotion to duty. Since joining his present unit, Sqn. Ldr. Gibson has destroyed three and damaged a fourth enemy aircraft. His skill was notably demonstrated when, one night in July, 1941, he interrupted and destroyed a Heinkel 111.

Act. Wing Cdr. J. CUNNINGHAM, D.S.O., D.F.C., A.A.F., No. 604 Squadron.—Wing Cdr. Cunningham continues to uphold and improve his outstanding record as a night fighter pilot. With his observer-airgunner, P/O. Rawnsley, brilliant tactics and perfect team work have been displayed in the pursuit of enemy aircraft at night. Since April, 1941, they have added a further four enemy aircraft to previous victories. Throughout the operations, Wing Cdr. Cunningham has been greatly assisted by P/O. Rawnsley, whose skill has been outstanding.

DISTINGUISHED FLYING CROSS

P/O. C. F. RAWNSLEY, D.F.M., No. 604 Squadron.—For citation see Wing Cdr. Cunningham, D.S.O.

Act. Wing Cdr. J. R. CREE, No. 110 Squadron.—In August, 1941, this officer led a formation of our aircraft which attacked an industrial plant at Lille. In the face of intense anti-aircraft fire, Wing Cdr. Cree succeeded in obtaining direct hits on the works. Later in August, 1941, Wing Cdr. Cree was the leader of a formation which carried out a low level attack on shipping in the docks at Rotterdam. Anti-aircraft fire, which was encountered as the formation crossed the Dutch coast, became intense in the target area, but Wing Cdr. Cree skilfully led the formation to the attack and, from a height of 50 feet, scored direct hits on a large merchant vessel while the remainder of our aircraft attacked shipping and dock installations inflicting great damage. Wing Cdr. Cree has completed forty operational missions and has proved a magnificent and courageous leader.

Act. Sqn. Ldr. H. F. BURTON, No. 616 Squadron.—This officer has led his squadron with commendable skill and coolness. He has participated in fifty-four sorties over enemy territory during which he has assisted in the destruction of two Messerschmitt 109s, probably destroyed a Heinkel 111 and damaged a further two enemy aircraft. Sqn. Ldr. Burton has on all occasions proved an inspiration to his unit.

Flt. Lt. J. HAMLYN, No. 250 Squadron.—In August, 1941, this officer was the leader of a formation of aircraft engaged on a defensive patrol of our ships sailing to Tobruk. The formation was attacked by some thirty Italian fighters, but Flt. Lt. Hamlyn, displaying resource and magnificent leadership, kept his formation intact and frustrated all attempts of the enemy to bomb the convoy. On a previous occasion, Flt. Lt. Hamlyn, whilst carrying out a low flying attack in the Gambut area, was forced to land in enemy territory. With the help of friendly Arabs he was able to regain his unit after walking a distance of about eighty miles. Flt. Lt. Hamlyn has destroyed two enemy aircraft.

P/O. C. P. RUDLAND, R.A.F.V.R., No. 263 Squadron.—This officer, who recently assumed command of his flight, has performed exceptionally fine work in the course of offensive operations against the enemy, including a determined attack on an enemy aerodrome, a successful attack on a wireless station and important operations carried out in the Cherbourg area. On one occasion he destroyed a Messerschmitt 109 which was taking off. On another occasion, P/O. Rudland displayed great coolness and courage when engaging and destroying one of a vastly superior number of enemy fighters. In August, 1941, whilst leading a section on an offensive operation, he attacked an enemy aerodrome at almost ground level. P/O. Rudland has displayed a high standard of leadership and courage.

P/O. L. C. GREGORY, R.A.F.V.R., No. 149 Squadron.—One night in August, 1941, P/O. Gregory and Sgt. Billington were captain and rear

HARD HEADED. British parachutists, all volunteers, now constitute a large, thoroughly trained force all ready for aggressive action. This picture shows the special latex helmet they wear.

STIRLING INTERIOR: The engineer (left) and radio-operator (right) at their respective positions in a Short Stirling.

FLEDGLINGS Flying schools all over the Empire are training thousands of R.A.F. pilots. Here is a group of pupils at an E.F.T.S. in Southern Rhodesia leaving their Tigers after the morning's instruction.

gunner respectively of an aircraft which was detailed to attack a target at Duisburg. Whilst flying through a large belt of searchlights in the target area the aircraft was attacked by an enemy fighter and sustained severe damage—the rear turret was put out of action, the wireless transmitter rendered unserviceable, the hydraulics hit, and with other damage also received the aircraft became practically uncontrollable. The second pilot was seriously wounded and the observer cut on the head. A large fire broke out near the rear turret, occupied by Sgt. Billington, enveloping it in flames. Intercommunication was impossible and, in the circumstances, Sgt. Billington, completely unaware of anything that was happening in the front of the aircraft, might have been justified in thinking that the aircraft was going down in flames. Undaunted, he got out of his turret and, regardless of the fact that he was drenched with oil, attempted to extinguish the fire with his hands. He then obtained his parachute from the turret and used it to smother the flames. Later, Sgt. Billington was able to secure a fire extinguisher with which he finally put out the fire. In the face of great difficulties P/O. Gregory flew the aircraft back to this country and made a safe landing. Throughout, P/O. Gregory showed great determination and fortitude while Sgt. Billington displayed great courage and a complete disregard for his safety. Both have previously participated in numerous operational missions.

Flt. Lt. L. H. Casson, A.A.F., No. 616 Squadron.—This officer has been engaged on operations over a long period and has destroyed two, probably destroyed four and damaged a further two enemy aircraft. Flt. Lt. Casson carried out many offensive patrols following the Dunkirk evacuation and later fought in the Battle of Britain. This year he has participated in a large number of offensive patrols over Northern France. His efficiency, leadership and courage have set an excellent example.

Sqn. Ldr. A. D. Nesbitt, R.C.A.F., No. 401 Squadron.—This officer has displayed fine leadership and exceptional devotion to duty throughout a long period of active operations against the enemy. On a particular occasion in December, 1940, Sqn. Ldr. Nesbitt led a section of aircraft over the sea for two hours without wireless assistance in extremely adverse weather conditions; visibility was practically nil. His judgment enabled the section eventually to land safely, although their petrol was practically exhausted, without loss to personnel. Sqn. Ldr. Nesbitt has destroyed two enemy aircraft.

Act. Sqn. Ldr. J. H. Thompson, R.A.F.O., F/O. W. J. O. Coleman, both of No. 269 Squadron, Coastal Command.—Sqn. Ldr. Thompson and F/O. Coleman were pilot and navigator/bomb-aimer respectively of an aircraft in which they carried out a successful attack on an enemy submarine. In very poor weather conditions, F/O. Coleman skilfully navigated to the position and, co-operating splendidly with his pilot, attacked with such good effect that the submarine surfaced.

When Sqn. Ldr. Thompson opened fire with his machine-guns, the submarine crew waved a white flag. One of His Majesty's Destroyers later took charge of the submarine. The success of the operation was undoubtedly due to the splendid teamwork of these two officers. Both Sqn. Ldr. Thompson and F/O. Coleman have previously carried out numerous operational missions.

Sqn. Ldr. K. V. Knowles.
Act. Sqn. Ldr. J. T. Bouwens, R.A.F.O., No. 51.
Act. Sqn. Ldr. G. K. Lawrence, R.A.F.O., No. 76.
Act. Sqn. Ldr. J. D. Reardon, No. 51.
Act. Sqn. Ldr. J. A. Slater, R.A.F.O., No. 150.
Act. Flt. Lt. J. R. A. Careless, No. 35.
Act. Flt. Lt. P. W. M. Carlyon, No. 150.
Act. Flt. Lt. J. Hurry, No. 51.

Distinguished Flying Medal.

Sgt. W. Billington, R.A.F.V.R., No. 149 Squadron.—For citation see P/O. Gregory, D.F.C.

Sgt. R. S. Colvin, No. 38 Squadron.—One night in August, 1941, this airman pilot carried out an attack on shipping in Tripoli harbour from a height of 1,500 feet. Defying an intense barrage, Sgt. Colvin secured hits on two ships, setting them both on fire. The flames acted as beacons to following aircraft thus enabling them successfully to attack targets in the harbour. Sgt. Colvin has completed forty six operational missions and has at all times displayed great skill, courage and determination.

Air Sgt. F. Joubert, S.A.A.F., No. 24 Squadron.—In August, 1941, this airman was lower gunner of an aircraft which was attacked by six enemy fighters while returning from bombing an enemy aerodrome. As a result, part of the aircraft was set on fire while the top gunner was seriously wounded. Sgt. Joubert attempted to extinguish the fire but his efforts were unavailing. His captain by this time, had flown the aircraft over land and ordered the crew to abandon it but, as the intercommunication was out of action, neither Sgt. Joubert nor his wounded comrade heard the instruction. On seeing the pilot and observer leaving the aircraft, Sgt. Joubert realised the position and immediately assisted his wounded comrade from his turret to the bottom escape hatch where the wounded gunner's parachute harness became entangled on the rear sight of a gun. Lifting the gun from its mounting, Sgt. Joubert dropped both gun and gunner through the hatch. While doing so, the fore-sight of the gun caught the rip cord of Sgt. Joubert's parachute causing it to open inside the aircraft. Gathering up the parachute in his arms, Sgt. Joubert then jumped, falling to within 1,000 feet of the ground before his parachute opened properly. Throughout Sgt. Joubert displayed remarkable coolness and great gallantry in assisting his badly wounded comrade to escape from the burning aircraft.

Sgt. T. O. Rigler, No. 609 Squadron.—This airman has carried out 82 sorties since March, 1941. He has displayed outstanding keenness to destroy the enemy in combat and to harass him on the ground. Sgt. Rigler has destroyed at least seven hostile aircraft (three were destroyed in one swoop) and has damaged a further two.

UNOFFICIAL CHAT. The Hon. E. Lucas Guest, Minister for Air for Rhodesia, shares a joke with Air Comdre. C. W. Meredith, A.F.C., in command of the Air Training Group there.

SERVICE AVIATION

Awards Gained in the Cologne Raid

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

On the morning of 12th August, 1941, Blenheim bombers carried out simultaneous attacks on the great power stations near Cologne. A strong force attacked the station at Knapsack, whilst a smaller force attacked two stations at Quadrath. These missions involved a flight of some 250 miles over enemy territory, which was carried out at an altitude of 100 feet. At Knapsack the target was accurately bombed and machine gunned from between 200 and 800 feet and at Quadrath both power stations were hit from the height of the chimneys; the turbine house at one of the two stations was left a mass of flames and smoke. The success of this combined daylight attack and the co-ordination of the many formations of aircraft depended largely on accurate timing throughout the flight. That complete success was achieved, despite powerful opposition from enemy ground and air forces, is a high tribute to the calm courage and resolute determination displayed by the following officers and airmen, who participated in various capacities as leaders and members of the aircraft crews:—

Distinguished Service Order.

Act. Wing Cdr. J. O. C. Kercher, No. 21 Squadron; Act. Wing Cdr. J. L. Nicol, No. 114 Squadron. (Missing.)

Distinguished Flying Cross.

Act. Sqn. Ldr. W. J. Edrich, R.A.F.V.R., No. 21 Squadron; Act. Sqn. Ldr. A. S. Hudson, No. 114 Squadron; Act. Sqn. Ldr. R. J. W. Mearns, R.A.F.V.R., No. 82 Squadron; Act. Sqn. Ldr. R. T. Stubbs, No. 139 Squadron; Act. Flt. Lt. R. J. Chamberlain, R.A.F.V.R., No. 139 Squadron; Act. Flt. Lt. P. J. Channer, R.A.F.V.R., No. 18 Squadron; Act. Flt. Lt. F. E. H. Charney, R.A.F.V.R., No. 107 Squadron; F/O. H. J. Madden, R.A.F.V.R., No. 114 Squadron (Missing); Act. F/O. T. H. Baker, D.F.M., No. 114 Squadron; P/O. H. R. Crombie, R.A.F.V.R., No. 139 Squadron.

Distinguished Flying Medal.

Flt. Sgt. B. G. Evans, No. 21 Squadron; Sgt. J. H. Pilley, No. 18 Squadron; Sgt. J. D. Woodburn, R.C.A.F., No. 18 Squadron.

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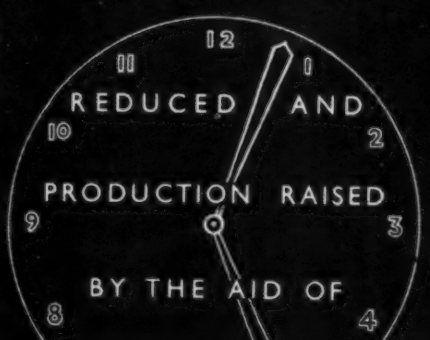

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